THE RHODESIA
Agricultural Journal.

Issued by Authority of
the Minister of Agriculture and Lands.

VOLUME XXXIX.

1942.

SALISBURY:
PRINTED FOR THE GOVERNMENT STATIONERY OFFICE
BY THE ART PRINTING WORKS, LTD., SALISBURY.

The Rhodesia Agricultural Journal.

INDEX.

Volume XXXIX. 1942.

	Pages.
January	1—44
March-April	45—143
May-June	145—225
July-August	227—323
September-October	325—410
November-December	411—513

EDITORIALS	Page
Agricultural Cleanliness Now	147
Analyses of Rhodesian Foodstuffs	327
Anti-Waste Measures	145
Book Notices and Reviews	148
Cleanliness by Law	327
Compost	46
Dairying and The War Effort	45
Diesel Engines on Farms: Operations and Maintenance of	1
Dried Foods	413
Food Production Committee: Factual Background No. 23	411
Grain Bins	228
Historical Dip Tank	325
Humus and the Farmer	146
Hybridisation	411
Interesting Developments made in Medical Pecten	4
Jack, Mr. R. W.: Retirement of	147
Livestock Improvement Scheme	227
Maize and Wheat Certified Seed	227
New Machines for Britain's Harvest	411
Oyster Nuts	325
Pedigree Pig Breeders' Association	49
Plants: Economic Value of	412
Plastic Motor Car Body	5
Sacks: A Simple Treatment for Preserving	326
Soil Erosion: Storm Water Drainage ...	411
Soil and the Farmer	228
Sweating Sickness of Cattle	414
Tobacco Aphid: Winter Host Plant of the	229
Tobacco Fertilisers	47
Tobacco Seed: Treatment of	228
Tobacco, Turkish ...	414
Tobacco, Turkish: Good Prices for	145
Vegetable Seed: Production of	326
Vegetables in Britain	3
War on Weevils is War on Waste	6

FARM HOME. Page.

Recipes ... 399 and 496
Preserving Fruits ... 131

ANNUAL REPORTS.

Agricultural Experiment Station 1940/41. By H. C. Arnold ... 167

LIVESTOCK AND VETERINARY.

Bacon Pigs: Soft Fat in. By C A Murray, M.Sc., Agric. 69
Beef: The Production of Rhodesia Best. By A. E. Romyn, Ph.D. 15
Calves: Hand-rearing of. By C. A. Murray and A. E. Romyn .. 442
Dipping Tanks: The Construction of. By B. G. Gundry, A.I.Mech.E., and J. M. Sinclair, M.R.C V.S. ... 244
Diseases: Laboratory Diagnosis. Part 11 By J. M. Williamson 90
Hides: Something about. By "Ex-Tanner" ... 498
Milk Records: Rhodesian . 38, 222, 296, 406, 509
Milking Machine: Report on use of a 4-unit Gascoigne. By C. A. Murray, M.Sc., Agric. ... 265
Milking Machine: Report on use of 4-unit Gascoigne. Observations. By R John Unsworth ... 369
Poisoning of Stock by Nitrate of Soda. By P. D. Huston, M.R.C.V.S. ... 88
Steers: "Rhodesia's Best." Cost of Fattening and the Importance of Compost as an Item of Profit By S. D. Timson and G. L Black ... 21
Sweating Sickness By D. A. Lawrence, B.V.Sc. . 236
Tick Transmission of Disease By D. A Lawrence, B V.Sc . 500
Veterinary Reports ... 42, 140, 223, 321, 405, 510

POULTRY

Culling of Laying Hens By G H Cooper . 486
Egg Laying Test: The 22nd. Annual Southern Rhodesia Official . 138
Poultry Parasites. By H. G. Wheeldon ... 358
Respiratory Diseases of Poultry and their Treatment: Brief Notes on. By The Poultry Branch ... 110
Turkey, The By G. H Cooper ... 433

TOBACCO

Tobacco Aphid By Chas. K. Brain, M A., D.Sc 241
Tobacco: Harvesting and Curing Virginian Type By D. D. Brown 51
Tobacco, Turkish. By J. C. Collins. B Sc . . 449

CROPS.

Cotton Growers: Bulletin for By G S Cameron . 341
Farming Calendar ... 29, 134, 219, 400, 506
Oyster Nuts: Notes on a trial planting of. By S. M. Sinclair 332
Potato, The. By S. D. Timson, M.C. ... 274
Potatoes: Some Light on the Sprouting of Seed. By E. T. Morgan 177
Soya Bean. By H. C Arnold ... 384, 418
Vegetable Growing in Southern Rhodesia. By G. W. Marshall 179
Wheat: Brief Characteristics of Varieties Tested. By T K. Sansom, B.Sc. ... 11
Wheat: A Description of the more Common Rhodesian Varieties. By T. K. Sansom, B.Sc. ... 477

IRRIGATION AND SOIL CONSERVATION.

Gully Control: Some Recent Successes. By Douglas Aylen .. 73
Soil Conserving in Native Reserves By Douglas Aylen 152

ENTOMOLOGY AND PLANT PATHOLOGY

Diseases of Cabbages and Cauliflowers. By J. C. F. Hopkins, D.Sc. (Lond.), A.I.C.T.A., and Marie H. Pardy ... 376
Diseases and Pests: Hints on the Control of. By J. C. F. Hopkins, D.Sc. (Lond.), A.I.C.T.A., and A. Cuthbertson, F.R.E.S. 192
Locust Invasion 1932-42 ... 44, 143, 225, 323, 410, 513
Skin Maggot Fly. By Alexander Cuthbertson, F.R.E.S. ... 149
Ticks Infesting Domestic Animals in Southern Rhodesia By Rupert W. Jack ... 95, 202
Tsetse Fly Operations, 1941. By J. K. Chorley ... 231

MISCELLANEOUS. Page

Battery Charging. By Major C. E. Goad, M.C. 504
Bulletins: Departmental, List of 305
Charcoal for Gas Producer Plants. By Conservator of Forests, etc. 334
Compost: Garden. By S. D. Timson, M.C. 8
Compost: Kraal. By S. D. Timson, M.C. 161
Compost Making: An Improved Implement for use in. By J. D. Scott 404
Food Production Committee: Factual Background No. 23. By the Minister of Information of United Kingdom 415
Grain Storage Bins. By Irrigation Department 353
Letters to Editor 329
New Machines for Britain's Harvest. By H. Isaacs 492
New Year's Message to Farmers in Southern Rhodesia . opposite p. 1
Obituary. A. Cuthbertson, Dip. Agric., F.R.E.S. 230
Obituary. H. M. Huntley, Esq., and Duncan Black, Esq. 328
Rhodesian Foodstuffs: Analyses of. By Division of Chemistry . 391
Stramonium or Stinkblaar. By J. C. F. Hopkins, D.Sc. (Lond.), A.I.C.T.A 350, 484
Witchweed Demonstration Farm Auchendenny, Season 1940-41: Costings of Farm Operations. By S D Timson, M.C. and G. L Black 119

Contents.

MARCH-APRIL, 1942.

EDITORIALS— Page.

Dairying and the War Effort 45

Compost 46

Tobacco Fertilisers 47

Pedigree Pig Breeders' Association 49

ARTICLES—

Tobacco Culture in Southern Rhodesia: Harvesting and Curing Virginia Type Tobacco, by D. D. Brown, Chief Tobacco Officer 51

Animal Husbandry Notes. Soft Fat in Bacon Pigs, by C. A. Murray, Senior Animal Husbandry Officer in Charge, Government Experiment Station, Bulawayo 69

Gully Control: Some Recent Successes, by Douglas Aylen, Technical Assistant for Soil Conservation 73

Veterinary Notes: A Note on the Poisoning of Stock by Nitrate of Soda, by P. D. Huston, M.R.C.V.S. 88

Laboratory Diagnosis of Disease, by J. M. Williamson, B.Sc., M.R.C.V.S., Veterinary Research Department 90

Ticks Infesting Domestic Animals in Southern Rhodesia, by Rupert W. Jack, Chief Entomologist 95

Brief Notes on Respiratory Diseases of Poultry and their Treatment, by the Poultry Branch 110

Costings of Farm Operations on the Witchweed Demonstration Farm, Auchendinney, Season 1940-41, by S. D. Timson, Assistant Agriculturist; G. L. Black, Dip. Agric. (Durham), Manager 119

The Farm Home: Preserving Fruit 131

Farming Calendar, March and April 134

Twenty-second Annual Southern Rhodesia Official Egg-laying Test Results 138

Southern Rhodesia Veterinary Reports, December, 1941, and January, 1942 140

Southern Rhodesia Locust Invasion Reports, December, 1941, and January, 1942 143

Contents.

MAY-JUNE, 1942.

EDITORIALS—

	Page
Good Prices for Turkish Tobacco	145
Soya Bean Seed	145
Anti Waste Measures	145
Humus and the Farmer	146
Retirement of Mr R W Jack	147
Agricultural Cleanliness Now !	147

ARTICLES—

Book Notices and Reviews	148
The Skin Maggot Fly Life History and Preventive Measures by Alexander Cuthbertson F R E S Entomologist	149
Conserving Soil in the Native Reserves, by Douglas Aylen, Technical Assistant for Soil Conservation	152
Kraal Compost by S D Timson, M C, Assistant Agriculturist	161
Agricultural Experiment Station Salisbury Annual Report of Experiments, Season 1940-41, by H C Arnold, Manager	167
Some Light on the Sprouting of Seed Potatoes, by E T Morgan, Officer-in-Charge, Potato Branch Department of Agriculture, Perth	177
Hints on Vegetable Growing in Southern Rhodesia by G W Marshall, Government Horticulturist	179
How to Prevent Waste Hints on the Control of Diseases and Pests, by J C F Hopkins, B Sc (Lond), A I C T A., and A Cuthbertson, F R E S	192
Ticks Infesting Domestic Animals in Southern Rhodesia, by Rupert W Jack, Chief Entomologist (continued)	202
Farming Calendar	219
S R Milk Recording Scheme Herd Averages, 1940 41	222
Southern Rhodesia Veterinary Report, February, 1942	223
Southern Rhodesia Veterinary Report March 1942	224
Southern Rhodesia Locust Invasion Reports February and March 1942	225

THE TURKISH TOBACCO CO-OPERATIVE COMPANY OF RHODESIA LIMITED

DARWENDALE

1942 TURKISH TOBACCO SEASON

The above Company will be prepared to handle, pack, mature and sell Turkish Tobacco Crops for non-members on the same basis as members plus a commission of 5%.

Turkish Tobacco has been successfully handled and packed for over 30 years at Darwendale, and the Company after a run of eleven years has brought the industry to its present sound position.

A competent staff fully qualified with many years experience are ready to handle the leaf.

This Company represents the oldest Turkish Growers in the country.

Contracts have been entered into for 3 years for all leaf it can ship at prices in excess of all previous records.

Buyers are offering large Bonuses for larger production.

60% cash advances are made on delivery free of interest. Further advances are made later in the season.

Last year's final costs are approximately 2d. per lb. inclusive of grading, weighing, maturing and administration, but final figures cannot be given until shipments have been completed.

It is estimated that the average total payout for 1941 Crop will be in the neighbourhood of 1/4d. per lb. The 1942 Crop will be higher.

Full particulars and advice may be obtained from the Company's Offices at Darwendale.

Phone No. 5, Darwendale.

Consignments may be sent carriage forward by rail or road to the Company's Warehouse at Darwendale Station.

YOUR WAR EFFORT!

PLANT TURKISH AND GET DOLLARS!!

Contents.

JULY-AUGUST, 1942.

EDITORIALS—	Page
Livestock Improvement Scheme: Apply Now	227
Certified Seed Maize and Wheat	227
Treatment of Tobacco Seed: Chemistry Branch	228
Grain Bins	228
The Soil and the Farmer	228
Winter Host Plant of the Tobacco Aphid	229
Obituary: Alexander Cuthbertson, Dip. Agric., F.R.E.S.	230

ARTICLES—	
Tsetse Fly Operations 1941: Short Survey of the Operations by Districts for the year ending December, 1941, by J. K. Chorley, Entomologist	231
Sweating Sickness, by D. A. Lawrence, B.V.Sc., Director of Veterinary Research	236
The Tobacco Aphid: Destruction of Winter Host Plants, by Chas. K. Brain, M.A., D.Sc., Research Entomologist, Tobacco Research Station, Trelawney	241
The Construction of Dipping Tanks, by B. G. Gundry, A.I.Mech.E., and Notes on their Management by J. M. Sinclair, M.R.C.V.S., Chief Veterinary Surgeon	244
Report on the use of a 4-Unit Gascoigne Milking Machine at the Government Experiment Station, Rhodes Matopo Estate, by C. A. Murray, M.Sc. Ag., Senior Animal Husbandry Officer in Charge, Rhodes Matopo Estate	265
The Potato: Methods of Cultivation in Southern Rhodesia, by S. D. Timson, M.C., Assist. Agriculturist	274
Southern Rhodesia Milk Records	296
Departmental Bulletins	305
Southern Rhodesia Veterinary Report, April, 1942	321
Southern Rhodesia Veterinary Report, May, 1942	322
Southern Rhodesia Locust Invasion Reports: April, 1942, May, 1942 and June, 1942	323

NOTICE

A LIVESTOCK IMPROVEMENT SCHEME

STOCK FARMERS are advised that applications for assistance towards the purchase of stock in terms of the above-named Scheme during the current financial year ending 31st March, 1943, should be submitted to the undersigned, P.O. Box 387, Salisbury, as soon as possible and not later than 31st July, 1942. In view of the present situation it is necessary to exercise every possible economy and **applications submitted after the 31st July will only be dealt with if funds are available** and if the necessary inspections can be arranged economically with the limited staff now available.

Stock Farmers who wish the Livestock Improvement Committee to select or purchase bulls on their behalf are particularly urged to make application **now** for any bulls that they may require during the present year. In past seasons the delay in making these applications until close to the time the bulls were actually required for service, has made it impossible to fill many orders satisfactorily.

The conditions of the Livestock Improvement Scheme follow more or less the lines of the Scheme in operation in previous years. Facilities are provided in approved cases for both an outright grant and loan towards the purchase of good sires and, in certain circumstances, similar assistance may be given towards the purchase of pure-bred female stock.

The Scheme applies to cattle, sheep and pigs, and Stock Farmers are urged to make the fullest possible use of the facilities available. Full particulars may be obtained from the undersigned.

It should be clearly understood that applications are not carried forward from year to year, and any applicants who applied under last year's Scheme (i.e., prior to the 1st April, 1942) and who did not take advantage of any grant approved must re-submit their applications for consideration in terms of the current Scheme.

Breeders who have bulls, rams or boars for sale, which are likely to be suitable for use under the Livestock Improvement Scheme, are asked to send particulars of the animals for sale, as they become available, to the Secretary, Department of Agriculture and Lands.

Animals bred in Southern Rhodesia on which grants are to be claimed must be approved and marked prior to purchase by the Applicant. Departures from this rule will only be made in special cases and when the necessary inspection can be arranged without undue expense.

(Sgd.) H. G. MUNDY,

Secretary,

Department of Agriculture and Lands.

Contents.

SEPTEMBER-OCTOBER, 1942.

EDITORIALS — Page

Oyster Nuts — 325
Historical Dip Tank — 325
Production of Vegetable Seeds — 326
A Simple Treatment for Preserving Sacks — 326
Analyses of Rhodesian Foodstuffs — 327
Cleanliness by Law — 327

Obituary—Mr. H. M. Huntley and Mr. Duncan Black — 328

Letters to the Editor — 329

ARTICLES

Notes on a Trial Planting of Oyster Nuts in the Mid Melsetter District, by S. M. Sinclair, Albany, Melsetter — 332
Charcoal for Gas Producer Plants, by the Conservator of Forests, in consultation with the Technical Sub-Committee on Producer Gas Plants — 334
Bulletin for Cotton Growers, by G. S. Cameron, Cotton Research and Industry Board — 341
Stramonium or Stinkblaar, a Medicinal Herb required for War Purposes, by J. C. F. Hopkins, D.Sc. (Lond.), A.I.C.T.A., Senior Plant Pathologist — 350
Grain Storage Bins, contributed by the Irrigation Department — 353
Poultry Parasites, by H. G. Wheeldon, Poultry Officer — 358
Report on the Use of a 4-Unit Gascoigne Milking Machine. Observations by Mr. R. John Unsworth, on the Report of a 4-Unit Gascoigne Milking Machine at the Government Experimental Station, Rhodes Matopo Estate — 369
Diseases of Fruit, Flowers and Vegetables in Southern Rhodesia. 6—Virus Diseases of Cabbages and Cauliflowers, by J. C. F. Hopkins, D.Sc. (Lond.), A.I.C.T.A., and Marie H. Pardy, B.Sc., Branch of Plant Pathology — 376
Soya Beans, by H. C. Arnold, Manager, Agricultural Experiment Station — 384
Analyses of Rhodesian Foodstuffs, by the Division of Chemistry — 391
The Farm Home: Recipes — 399
Farming Calendar — 400
An Improved Implement for use in Compost making, by J. D. Scott, in "Farming in South Africa" — 404
Southern Rhodesia Veterinary Report, June, 1942 — 405
Southern Rhodesia Milk Records — 406
Southern Rhodesia Locust Report, July, 1942 — 410

Contents.

NOVEMBER-DECEMBER, 1942.

	Page.
EDITORIALS—	
Food Production Committee: Factual Background No. 23	411
Soil Erosion: Storm Water Drainage	411
New Machines for Britain's Harvest	411
Hybridization	411
Economic Value of Plants	412
Acknowledgements	413
Dried Foods	413
Sweating Sickness of Cattle	414
Turkish Tobacco	414
ARTICLES—	
Food Production Committee: Factual Background No. 23, issued by the Minister of Information of the United Kingdom	415
Soya Beans (continued), by H. C. Arnold, Manager, Agricultural Experiment Station	418
The Turkey, by G. H. Cooper, Assistant Poultry Officer	433
Hand rearing of Calves, by C. A. Murray and A. E. Romyn, Division of Animal Husbandry	442
Turkish Tobacco: Culture and Marketing in Southern Rhodesia, by J. C. Collins, B.Sc., Assistant Tobacco Officer	449
A description of the more common Rhodesian Wheat Varieties, by T. K. Sansom, B.Sc., Plant Breeder	477
Stramonium: Further details regarding Collecting and Marketing of the Leaves, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Senior Plant Pathologist	484
Modern Culling of Laying Hens, by G. H. Cooper, Assistant Poultry Officer	486
New Machines for Britain's Harvest, by H. Isaacs, Machinery Officer to the Surrey War Agricultural Executive Committee	492
The Farm Home: Recipes	496
Something about Hides, by "Ex-Tanner"	498
Tick Transmission of Disease, by D. A. Lawrence, B.V.Sc., Director of Veterinary Research	500
Battery Charging, by Major C. E. Goad, M.C., Boring Superintendent	504
Farming Calendar	506
Rhodesian Milk Records	509
Southern Rhodesia Veterinary Reports	510
Southern Rhodesia Locust Reports	513

Contents.

JANUARY, 1942

EDITORIALS— Page.

Operation and Maintenance of Diesel Engines on Farms 1

Vegetables in Britain . 3

Interesting Developments made in Medical Pectin . 4

Plastic Motor Car Body .. 5

War on Weevil is War on Waste 6

ARTICLES—

Page

Garden Compost, by S. D. Timson, M.C., Asst. Agriculturist 8

Wheat: Brief Characteristics of Varieties Tested at the Plant Breeding Station, Salisbury, and available for Distribution, by T. K. Sansom, B.Sc., Plant Breeder 11

The Production of "Rhodesia Best" Beef, by A. E. Romyn, Chairman, Pasture Research Committee 15

Costs of Fattening "Rhodesia's Best" Steers, and the Importance of Compost as an Item of Profit, on the Witchweed Demonstration Farm, by S. D. Timson, M.C., Asst. Agriculturist and G. L. Black, Dip. Agric. (Durham), Manager 21

Farming Calendar for January and February 29

Rhodesian Milk Records 38

Southern Rhodesia Veterinary Report, November, 1941 ... 42

Locust Invasion Monthly Report, November, 1941 .. 44

New Year Message to Farmers

The year that is now passing has certainly been the most difficult and dangerous one the British Empire has ever experienced. At one time we were fighting alone and, with the unflinching courage of the British people, were able to frustrate the enemy from his attempt to dominate the British Isles. Now, with our Allies, we are gradually taking the offensive, and though the extension of hostilities to the Pacific has seriously increased the Empire's difficulties and anxieties, we shall certainly win through.

Here in Rhodesia with a shortage of man-power and one of the worst seasons on record behind us, the farmer and all business firms with which he has the closest contact have had many handicaps and serious disappointments to contend with. I congratulate one and all on the efforts they have made, and can only say that in the coming year those efforts must be redoubled if we are to increase production to the extent which is now necessary in order to feed the Colony, and at the same time maintain our output of tobacco and of products required in secondary industry.

As I have so often said, it is not within my power or right to tell a farmer what to grow; every agricultural product which can be produced is required and if we can produce more than we ourselves need, there will be other parts of the Empire only too ready to take, at reasonable prices, any surplus which may arise.

I wish every member of the agricultural industry and those other industries which are so closely allied to agriculture, the compliments of the season, and would impress upon all that your efforts are essential to the well-being of Rhodesia, and will assist in hastening the day of victory to which we are all looking forward.

F. E. HARRIS,
Minister of Agriculture and Lands.

THE RHODESIA
Agricultural Journal

Vol. XXXIX.] No. 1 [JANUARY, 1942

Editorial

Notes and Comments

Important Announcement.

Owing to war conditions and the restricted supplies of paper the "Journal" will be published bi-monthly instead of monthly until further notice.

Operations and Maintenance of Diesel Engines on Farms

The following notes taken from the Union Press Service and slightly modified by the Boring Superintendent, Department of Agriculture, outline the most essential points in the operation and maintenance of diesel engines.

It is important in the small diesel engine to maintain the fuel pump and sprayer in a satisfactory condition, to use suitable fuel and lubricating oil, and to keep the fuel and oil systems clean.

Diesel engines should not be overloaded or run with either a smoky exhaust or at reduced speed. If a normal speed and load are maintained it will add a great deal to the life and efficiency of the engine. If the engine runs with a dirty exhaust it is probably because the fuel system is not working correctly; the piston will get dirty, resulting in uneconomical running of the engine and difficult starting. Both the fuel-oil filter and the lubricating-oil filter should be withdrawn frequently and rinsed in paraffin.

The lubricating oil in the sump should be changed as often as the maker's instructions require, subject of course,

to the conditions under which the engine is run. The maintenance of clean oil materially affects wear on the cylinder and bearings. Use clean utensils for the oil when filling. There is no economy in using cheap lubricating oils; use the kind recommended by the engine makers. The grade of oil should be changed for winter and summer operation, as in winter the wrong grade will give trouble in starting up. The quality of fuel oil should be carefully chosen. It should have a specific gravity of not more than .88. Most engine makers give a list of suitable fuel oils in their instruction books.

No attempt should be made to adjust the fuel pumps and spray valves without carefully reading through the instruction book. Markings on the flywheel or camshaft are usually provided for checking the fuel-pump settings. In all types of fuel pumps the plunger and barrel should be treated as one unit, as they have been lapped together to make a perfect running fit. If replacements are necessary owing to wear both a new plunger and barrel should be fitted.

The spray-nozzle valve should never be ground into the seat of the nozzle unless absolutely necessary. Generally, the cleaning of the valve and body will be sufficient to restore satisfactory working. If the valve needs regrinding it should be lightly ground in on its seat with the least possible amount of flour, emery and oil. It should be rinsed thoroughly clean in petrol after grinding. Hard or sharp tools, emery paper and powder should not be used, otherwise the valve and valve nozzle will be spoilt. Here again the valve and valve nozzle should be kept together as a pair. Care should be taken to clean all air from the fuel system after it has been reassembled. This can best be done by working the fuel pump by hand.

Actually to grind in spray nozzles is a highly skilled job and special tools are necessary for satisfactory work. After grinding is completed and the atomiser is assembled, it has to be set to inject at a definite pressure as laid down by the maker of the particular engine. To do this a special testing appliance is essential as judging the spray by the eye is impossible even to the most experienced mechanic. It is therefore considered advisable to keep a spare atomiser for each

cylinder and to replace those in use as they become defective. They should then be sent to a firm which undertakes to recondition atomisers.

The pistons should be withdrawn periodically and should be well cleaned of carbon. All rings should be freed by soaking the piston in paraffin. It is essential that the rings should be free in their grooves, and, if removed should be replaced in the same grooves with equally spaced gaps. The oil scraper rings and the holes in them, and also the holes behind the scraper rings must be thoroughly clean and free from carbon. The cylinder head should be well cleaned and at the same time the air and the exhaust valves should be well ground in.

When the piston is reassembled care should be taken to see that the rings enter the cylinder correctly. In fitting new rings, it is most important to get the proper gaps in the cylinder as given in the instruction book. When the cylinder head is replaced, it is necessary to see that the joint is well cleaned and equally spaced all over, so that, when bolted down, a pressure-tight joint is obtained. After the cylinder head is fitted, the air and exhaust tappet clearances should be checked and adjusted.

The diesel engine should not be run with the water jacket cold; it runs best and most efficiently with a water outlet temperature of 160 degrees to 180 degrees F.

Finally, it should always be remembered that the makers supply an instruction book to guide the operator on running and maintenance. The information given should be read through and thoroughly understood.

Vegetables in Britain

Britain's amateur gardeners are responding to the "Dig for Victory" drive by growing on their 1,600,000 garden allotments vegetables to the value of £20,000,000 a year. In addition, hundreds of tons of vegetables are being grown on railway embankments throughout the country. The Southern Railway alone have 13,000 allotments covering an area of 600 acres.

Even densely populated London has found room for over 38,000 allotments, while in the famous parks of the Metropolis an additional 350 acres are being farmed for food crops and 600 acres set aside for sheep grazing.

London's railwaymen are cultivating 2,700 of these allotments, covering 100 acres, while other workers of the London Passenger Transport Board have dug up 36 acres from which they hope to get 400 tons of potatoes. They are also working 120 acres of market garden land at London's chief bus depot.

Altogether apart from this, the London County Council is now farming 4,000 acres in the City's Green Belt and to-day the citizens of London own 15,000 head of pedigree cattle, 3,000 pigs, 7,000 head of poultry and 550 sheep.

Last year the City's farms had a record production of 360,000 eggs, 550,000 gallons of milk, 351 tons of meal, 1,668 tons of vegetables, and 81 tons of fruit.—"Industrial Publicity Unit."

Interesting Developments Made in Medical Pectin

Research is opening up a new market for the citrus grower in the medical use of pectin. Pectin, part of every diet that includes fruits and vegetables, is commercially manufactured from citrus fruits and from apples. Citrus pectin finds its way in enormous quantities into two great commercial food products industries; preserving and candy making. Third in importance is its use in household packages for home preserving.

The use of pectin in medicine and surgery is still in its infancy but is rapidly growing. Clinical trials are being made of its intravenous use as a blood substitute for treatment of shock. Dr. F. W. Hartman at the Henry Ford hospital in Detroit recently published reports on several such cases successfully treated. Research by the California Fruit Growers

Exchange has shown in the Laboratory that pectin has an advantage over gum acacia, which has also been used as a blood substitute, in that it does not accumulate in the liver and other organs. Since this "artificial blood" can be stored without refrigeration and kept for emergency use, it may prove of great value in wartime when ordinary blood transfusions are difficult or impossible.

Pectin has also served medicine in other ways before the present interest in blood substitutes. It is taken by mouth to treat diarrhoeas and bacillary dysenteries, and is used on wounds and burns to promote healing. Druggists are experimenting with its use as an emulsifying agent and stabilizer. In addition, some of the derivatives of pectin, such as pectic and galacturonic acids, are receiving attention in medical and pharmaceutical fields.—"The California Citrograph."

Plastic Motor Car Body

A motor car body of a plastic which reflects Ford's intensive effort to integrate industry and agriculture has been completed by the Ford Motor Co., Dearborn, Mich., and made its initial public appearance on August 13 at a Dearborn Day Celebration. A typical formula for the plastic calls for mixture of synthetic resin with the fibrous material derived from such crops as wheat, flax, ramie, hemp, and spruce pulp. The mixture is preformed through a suction device and moulded under 1,500 pounds of pressure per square inch.

Although the plastic body makes its appearance when a steel shortage threatens to cripple the auto industry's non-defence production, Ford officials point out that it is in an experimental stage and substitution for the conventional steel body on a production scale is still a long way off. The only steel in the superstructure of the body is found in the tubular welded frame on which are mounted the 14 plastic panels that make up the unit. The car with plastic body weighs about 2,000 pounds. A steel unit of comparable size weighs approximately 3,000 pounds.

A report based on the use of farm products by the Ford Motor Co. in building cars and trucks indicates that for each 1,000,000 units manufactured, it needs the following:—

Agricultural Item	Amount
Cotton	69,300,000 pounds.
Wool	3,204,000 pounds.
Wood	112,000,000 board feet.
Cattle	30,000 head to provide 1,500,000 sq. ft. of leather.
Soybeans	600,000 bushels.
Flax	118,000 bushels.
Tung Oil	195,000 gallons.
Hogs	20,000 head to provide 1,000,000 pounds of lard oil lubricant.
Corn	451,500 bushels.
Wheat	120,000 pounds as flour used in foundry.
Goats	87,500 head to provide 350,000 pounds of mohair material.
Jute	5,000,000 pounds.
Pine pitch	2,060,000 pounds.
Sugar cane	Enough to provide 2,500,000 gals. of molasses.
Honey Bees	83,000,000 bees to produce 6,000 pounds of beeswax.
Castor oil	150,000 gallons.

—"American Chemical Society News Edition."

War on Weevil is War on Waste

From one pound weight of maize slightly infested with weevil, but with no adults visible, 2,643 adult weevils were reared in Salisbury in ten months under room condition of temperature and moisture. These adults were removed (1,622 of them alive). In the following few months the maize was

reduced to empty shells by the grubs left within the grain and by the adults to which they gave rise.

It is obvious that a very few pounds of maize distributed in corners, crevices and rat holes in the shed *and its vicinity* can contribute to serious waste in stacked maize, even in the unlikely event of the maize being weevil-free in the first place. Cleanliness in the sheds and vicinity equal to that in the household is indicated and is by no means fantastic. Modification of field management can also reduce the initial infestation brought into the shed.

Get a copy of Bulletin No. 1161 on the Control of Maize Weevil (3d. from the Editor) and declare war on weevils in sheds and lands.

"Cleanliness Aids Insect Control."

ERRATUM.

"Diseases of Fruit, Flowers and Vegetables in Southern Rhodesia—5: Diseases of Potatoes" (Dec., 1941):—

Fig. 9, *Leaf drop streak.* This block has been printed upside down.

Garden Compost.

By S. D. TIMSON, M.C., Asst. Agriculturist.

Many enquiries have been received from amateur gardeners for a simplified method of making compost without employing kraal manure, and the following is a description of a simple method of composting on a small scale suitable for the gardener or householder.

Collect all waste materials of vegetable origin such as the leaves of all trees (including gums and Cedrela toona), weeds, and old and green veld grass; straw, maize trash, kitchen wastes. Sawdust, waste paper and rags in small quantities can also be included in the compost heap. Crops such as Napier Fodder, sunn hemp and munga can also be grown on any spare ground for providing large quantities of raw materials.

Build these wastes into a heap 3 yards wide by any convenient length, and 4 feet high. Keep the sides tidy, and the top of the heap level.

Commence with a layer 12 inches deep, and on this layer spread 3 inches of fresh kraal manure, or, if this is not obtainable, then Adco reagent at the rate of 100 lbs. for every 4 yards length of the heap should be evenly sprinkled over the surface. The Adco reagent is obtainable from the African Explosives and Industries, Ltd., Mutual Buildings, Salisbury, at £13 15s. 0d. per ton.

Then sprinkle evenly over the surface of the wastes three to four sackfuls of soil (preferably ant-heap if obtainable). Then lay down a further layer of 12 inches of waste materials on top of the first one, and add the Adco and soil, and continue building the heap up sandwich fashion in this way, until a height of 4 feet is reached.

WATER SUPPLY.

If you are making the compost in the summer, now wait until the rain penetrates the heap to a depth of 6 inches to 9

Turning the compost heap. This shows how the whole heap is moved forward a few feet.

inches, when the heap should be forked over, and all the materials, and the wet and dry portions of the heap in particular should be well mixed together. Work from one end or one side of the heap and throw the materials a convenient distance forward (about 3 to 4 feet) and rebuild the heap to the same approximate dimensions as before. *Whilst turning the materials should be shaken with the fork so that the new heap is left in a loose and airy condition so as to permit air to enter it.* Never trample on the new heap when turning.

If you have an ample water supply available you can make compost in the winter, and in this case each layer of the sandwich is sprinkled with water after the Adco and soil have been spread, so that the heap is just moist, but not sodden with water. Then, as soon as the heap is made, the first turn can be given immediately. At each turn after the first the unrotted outside portion of the heap must be turned to the inside.

Subsequent turns should be given at intervals of 10 to 14 days, or as soon as the temperature inside the heap obviously falls. This can be simply tested by keeping an iron rod stuck down into the heap and testing the heat of the rod by hand. A little experienced with this rough thermometer will soon teach when the next turn should be given. Usually after three or four turns the materials will have broken down into a dark-brown or black crumbly material, with the same appearance and smell as well-rotted leaf mould.

It is better to leave the heap for one month to mature before use, but for a crop such as potatoes, to which a heavy dressing of a complete fertiliser is also applied, it can be used at once.

In winter a little additional water must be sprinkled on the materials at each turn to keep them just moist. They should be kept as moist as a squeezed sponge. During long wet spells in summer turn the heap more frequently to assist aeration.

At the second turn the wastes should be covered with a greyish white fungous growth. The absence or scarcity of this at this turn indicates lack of air due to the heap being too compact or too wet. This fungous growth gradually disappears, and the materials then become dark brown or black.

The Adco reagent contains the necessary lime, but if kraal manure is used it is advisable to lightly sprinkle each layer, when building the heap, with wood ashes or agricultural lime, so that the surface appears grey. If the soil used is sandy double the quantity of wood ashes or lime.

RATE OF APPLICATION.

For garden purposes a quarter of an inch layer of compost over the surface of the soil is a fair dressing. It is equivalent to roughly 15 to 17 tons per acre. Double this quantity may be considered a heavy dressing, but on a poor soil which requires working up into a fertile condition as much as a 1 inch dressing (about 60 to 67 tons per acre) may be applied with advantage. Dressings of phosphatic fertilisers should be used in combination with compost, at the rate of one to three ounces per square yard.

After spreading the compost dig it well into the top 9 inches of soil.

The farmers who live in Mazoe,
Hate *Diplodia*—like those in Umboe,
But in every field,
They have increased their yield
For they all treat their seed—E. & O.E.

Wheat.

BRIEF CHARACTERISTICS OF VARIETIES TESTED AT THE PLANT BREEDING STATION, SALISBURY, AND AVAILABLE FOR DISTRIBUIION.

By T. K. SANSOM, B.Sc., Plant Breeder.

The following selected pure lines of wheats grown at the Plant Breeding Station, Salisbury, are available for free distribution to farmers.

The seed supplied should be used for bulking up for sowing on a larger scale; as the seed has been specially selected and very carefully rogued, it should be of use to members of the Seed Wheat Association who wish to obtain a foundation stock of pure line wheats. Although every care has been taken to ensure purity of seed, no guarantee can be given; small percentages of foreign varieties may occur through natural cross pollination or other causes. In the past, however, the seed distributed has shown remarkable purity and uniformity when grown in the field, and it is anticipated that the present stocks will show the same degree of purity and uniformity.

Applicants are requested to apply early, stating what varieties are required. Not more than four varieties can be supplied to each applicant and the amount of seed of each variety will depend on the number of applicants for each variety.

Applicants are requested to state clearly the station, siding or halt to which parcels are to be despatched as well as the postal address.

No applications can be considered which are received after the 28th February, 1942.

VARIETIES AVAILABLE FOR DISTRIBUTION.

1. Reward B.21-22.S.I.
2. Reward B.23-25.S.I.
3. Jubilee.
4. Kenya Governor.
5. Kruger.
6. Pioneer.
7. B.256. b.1.A.64(L)
8. Sabanero.
9. Granadero Klein.
10. 131.C-5.P
11. N.B.230.A.14(L)
12. Punjab 8A.
13. 122.D.1.T.L.
14. Karachi L.3
15. Pusa 4.

The two Reward strains have been grown on a fairly extensive scale during the past few years; they are beardless, rust-resistant, early maturing, have a very strong straw and are excellent milling wheats, but require a soil in good heart to yield well.

Jubilee—is a cross between Reward and Wit Klein Koren. It is a bearded wheat with very dense ear and exceptionally strong black awns; it is fairly rust resistant and matures a few days earlier than Karachi, Punjab 8A and Lalkasa Wali. The grain is of excellent quality and very favourable reports have been received of its milling qualities; straw strong; like Reward requires a rich soil.

Kenya Governor.—Known also as "Somers Koren" and "90 day wheat" has been grown on a large scale in every district of the Colony for a good many years. It is fairly rust resistant and is early maturing; under favourable conditions will yield an excellent crop. The straw is fairly weak and it appears to be more susceptible to frost than other varieties. A heavier rate of seeding is required for this wheat owing to its poor tillering habit and fairly large size of grain.

Kruger.—Is a bearded wheat with extremely strong glumes. Highly rust resistant; the straw is fairly weak and it will lodge badly when well grown. Good milling wheat.

Pioneer.—Is a cross between Reward and Wit Klein Koren. It is a little taller growing than Jubilee and tillers a little better. It is a bearded wheat with very dense ears

and exceptionally strong black awns. Fairly rust resistant, matures about three days later than Jubilee; strong straw. Like Jubilee and Reward requires a rich soil.

B.256.b. 1.A.64 (L).—Is a beardless wheat resistant to rust and fairly early maturing. This wheat has shown promise at the Plant Breeding Station and elsewhere.

Sabanero.—Is a bearded wheat. Resistant to rust; fairly late maturing and tall growing; appears to be very well suited to vlei lands well supplied with moisture. On rich irrigated lands is inclined to lodge. Under favourable conditions is one of the best yielding wheats grown in the Colony. A very promising wheat and where Karachi, Lalkasa Wali and Punjab 8A become badly rusted, a crop of Sabanero growing alongside will show only very slight traces of rust.

Granadero Klein.—Is a bearded wheat which is very resistant to rust; it is fairly tall growing and late maturing, taking about a week longer to mature than does Karachi.

131*C.5.P*.—Is a bearded wheat; it is probably the most rust resistant wheat grown in the Colony at present; yields well but late maturing, straw strong.

N.B.230.A.14(L).—Is a bearded wheat, resistant to rust and fairly early maturing. Has shown promise at the Plant Breeding Station and elsewhere.

Punjab 8A.—Is a bearded wheat; the growth characteristics, apart from the hairiness of the glumes, are similar in all respects to Karachi, which it has largely replaced. The seed grown under the same conditions as Karachi is always larger and has a more metallic appearance. Under favourable conditions it is most probably the highest yielding wheat grown in the Colony. It is susceptable to rust, however, and in those areas where rust attack is severe should not be grown, as a crop failure may result. Is very well suited to vlei conditions.

122.*D.I.T.L*.—Is a beardless wheat resistant to rust and fairly late maturing; straw strong. Has done well in variety trials on vlei land at Umvuma, when moisture conditions were favourable.

Karachi 3.—Is a red seeded selection from Karachi. Bearded, white chaff. Has a higher protein content than ordinary Karachi.

Pusa 4.—Has been grown for a good many years in this Colony. It is beardless, fairly susceptible to rust, but in those areas where the incidence of rust attack is not severe will yield well. It is probably the most early maturing wheat grown in the Colony; it makes little leaf growth and should be useful to those farmers who thresh by means of hand power.

Applications should be addressed to the Agriculturist, Department of Agriculture, P.O. Box 387, Salisbury.

THERE WAS AN OLD WOMAN.

There was an old woman who lived in the blue,
She had so many weevils she didn't know what to do.
She appealed to her natives who made her some floor brooms,
And she took them back home and she swept out her store rooms.
And this was not all, for, chuckling with laughter,
She swept down the stack and cleaned every rafter.
But she giggled too soon, for the weevils returned,
So she swept out again and had them all burned.
Though all these activities helped stem the tide,
She found weevils breeding in refuse outside.
With commendable effort she cleaned up the yard
(Though the rats in the neighbourhood thought that was hard).
This was most helpful, but all was not right,
For weevils matured in the stacks—out of sight.
She decided right then that the following season
She'd keep her lands clean for the very good reason
That clean sheds and lands play a very big role
By cleanliness aiding in insect control.
And now she'll not likely be troubled again,
'Cause she's building a reinforced bin for her grain.

Cleanliness Aids Insect Control.

Fig 2 - Weeners shortly after arrival

Fig 3 -- Steers shortly before they were railed to Bulawayo

The Production of Rhodesia Best Beef.

By A. E. ROMYN, Chairman, Pasture Research Committee.

GENERAL.

"Rhodesia Best Beef" became an official grade of beef on 1st September, 1941. Nearly two and a half years before this date, however, an experiment was started by the Pasture Research Committee of the Department of Agriculture* to find out what could be done with good average ranch weaners properly fed and finished off. Some of the results of this trial will be of interest to stock feeders and are published here as an indication of what may be expected from the purchase and feeding of weaners.

Fifty weaners for this particllar trial were purchased from the Central Estate, Umvuma, in February, 1939. They were of the Hereford-Africander type, mostly the progeny of grade Hereford bulls. When purchased they were 12-14 months of age and had no permanent incisor teeth. They were railed to the Grassland Experiment Station, Marandellas. On arrival there they were weighed after a rest and averaged 396 lbs. liveweight. They cost £3 each f.o.r. Umvuma.

In May, 1941, two years and three months later, they were railed to Government Experiment Station, Matopos, to be finished off. The 50 head then averaged 1018 lbs. liveweight.

Actually the weaners were divided into five groups of 10 head each managed under different systems of grazing. It will readily be appreciated that work of this nature must be carried on over a number of seasons to obtain reliable results. Most of the data will, therefore, not be ready for publication

* A. E. Romyn, Chief Animal Husbandry Officer, Chairman. A. D. Husband, Chief Chemist. D. E. McLoughlin, Agriculturist. H. C. Arnold, Manager, Experiment Station, Salisbury.

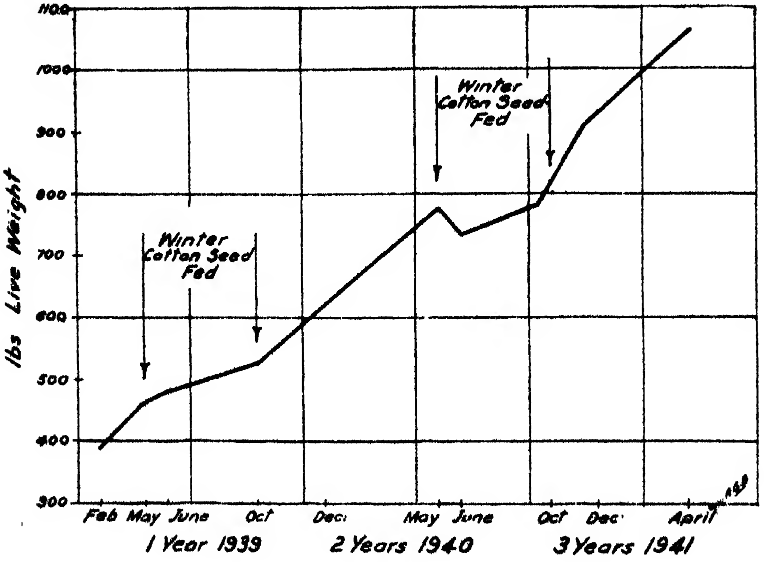
for another two or three years. There are, however, confirmatory data at Marandellas (1) and at the Rhodes Matopo Estate (2) on the results obtained with one group. This group (No. 5) was allowed more or less uncontrolled grazing and received a ration of whole cottonseed in the winter months. The results from this method of management have been so satisfactory at both stations referred to that it is considered that they can usefully be published now separately from the rest of the experiment.

DESCRIPTION OF THE EXPERIMENT.

The ten steers in this group were allowed 15 acres of grazing per head distributed over two camps—a dry camp in the wet season and a vlei camp for grazing towards the end of the winter. During the winter months they received a limited supplementary ration of 1-1½ lbs. of whole cotton seed per day. No other feed was given to them, but during the winter after the first rains, the rank, unusable surplus grass in the camps was burned off to provide an early bite. Good water and shelter was available and the cattle were dosed regularly for internal parasites. They had free access to salt.

RESULTS.

The weights of the steers are shown in the following graph:—



Attention is particularly directed to the fact that, on the feeding given, the cattle were able to maintain their weight approximately through the winter months and the usual drop of weight in the winter months, which does so much to stunt the growth of cattle in this Colony, was avoided.

The amount of feed consumed per head during the two winters was:—

	Cottonseed.	Sunnhemp. hay.	Length of feeding period.
First winter, 1939	134	72	May 24-Oct. 26
Second winter, 1940 . .	158	—	June 5-Sept. 30

The sunnhemp hay was used in the first winter to eke out the supply of cotton seed which ran out before the end of the month.

All 50 steers were railed from Marandellas on the 18th May, 1941, and arrived at the Government Experiment Station, Matopos, on the 20th May. Their condition on arrival was good and, after resting in a small paddock for a day, they were turned out on good grazing until June 2nd, when they were brought into the pens for feeding. The five groups were again separated and fattened on the same rations, close account being kept of the amount of feed necessary to bring each group to the same outward degree of finish. Only the results of group 5 are given here.

The ration fed to this group, and all the others, consisted of:—

Veld hay: Ad lib.

Cowpea hay: 5 lbs. per day.

Maize silage: Up to 40 lbs. per steer per day during the first six weeks. After that the allowance of silage was gradually reduced and the quantity of concentrates increased in proportion.

Concentrates: 5 - 14 lbs. per head of a mixture consisting of—

Maize meal: 400 lbs.
Hominy chop: 360 lbs.
Bonemeal: 15 lbs.
Salt: 7 lbs.

When the steers appeared to have reached a "Rhodesia Best finish" on outward appearance, they were sent to the Cold Storage Commission, Bulawayo, for slaughter. They were walked over night to the slaughter works, a distance of approximately 22 miles.

The live and dead weights of the steers follow:—

Final Marandellas weight	1,055	lbs.	average	per	steer.
Final Matopo weight before slaughter	1,210	,,	,,	,,	,,
Weight into the pens at Matopos	984	,,	,,	,,	,,
Gain in weight	226	,,	,,	,,	,,
Daily gain	2.1	,,	,,	,,	,,
Cold dressed weight	705	,,	,,	,,	,,
Average dressing per cent.	58.3	%	,,	,,	,,

Grading: Rhodesia Best . 6 head.
Imperial .... 4 head.

Average price realised per head: £14 10s. 3d.

The "Rhodesia Best" grade may be described as beef derived from well finished steers of beef conformation showing not more than six permanent incisor teeth. All ten steers were judged to have the Rhodesia Best finish but 4 had 8 permanent incisor teeth showing when slaughtered and were accordingly degraded to the "Imperial grade."

The feed required to finish these steers was:—

	Total feed consumed per head	Feed required per 100 lbs. gain in liveweight.
Veld hay	905	400
Cowpea hay	905	241
Maize silage	2,551	1,129
Concentrates	1,254	555

Age of Steers.—It is interesting to note that the 50 bullocks, which at the time of slaughter were approximately 3¾ years of age, showed the following dentition:—

8	permanent	incisor	teeth	11 head
6	,,	,,	,,	37 ,,
4	,,	,,	,,	2 ,,
				50 head

DISCUSSION OF RESULTS.

From the experience we have had so far, these results can be taken to represent what may be expected from fair quality ranch weaners in favourable seasons and with proper management. The quantity of winter feed required will naturally vary with the season and the amount of fattening feed necessary will depend on the quality and weight of the store bullocks, but the quantities of feed consumed in this trial seem typical under the conditions described in this experiment. The manure made in the fattening period, an important economic consideration, is not brought to account in these results.

It may be asked why these steers were sent to Bulawayo and not finished at Marandellas. The reason is that there is little agricultural land on the Grasslands Station and it is considered more profitable under such conditions to spread out the feed among a number of weaners rather than to concentrate it in the finishing of a few bullocks. The same principle would apply on many similar sandveld farms throughout the country which are better suited on this account for growing rather than fattening cattle.

Similar results to those with the cotton seed in these experiments have been obtained at the Matopos with 1½ lbs. of a protein concentrate mixture containing 18% of crude protein (3) and at the Marandellas station (4) by feeding 5 lbs. of legume hay per day.

The practical lesson of all this work is that the weaners will nearly always grow out into satisfactory stores for fattening, provided *there is no undue loss of weight in the winter*. An efficient way to prevent this loss under our conditions is to feed a protein supplement similar to those just cited, as protein is the nutrient most likely to be lacking in the grazing during the winter. In a good winter little feed may be required to prevent this loss in weight, but provision to have the necessary feed on hand should always be made.

SUMMARY.

The results of this experiment indicate that—

(1) On the ordinary sandveld in Mashonaland, of which Marandellas is quite representative, it is possible to

grow out a 400 lb. ranch weaner to a 1,000 lb. store bullock in a little over two years at a feed cost for the two winters of approximately 400 lbs. of whole cottonseed.

(2) Such stores can be finished as "Rhodesia Best" beef to "dress out" at about 700 lbs. on approximately the following quantities of feed:—

Concentrates: 6 bags.
Legume hay: ¼ ton.
Maize silage: 1¼ tons.
Veld hay: ½ ton.

These quantities should serve as a useful guide to the amount of feed necessary under sandveld conditions to produce Rhodesia Best beef from the weaner stage to the finished bullock. By placing values on these feeds to suit individual circumstances the cost of this feed can be arrived at rapidly.

ACKNOWLEDGMENT.

Acknowledgment must be made here of the practical assistance and co-operation of Mr. R. H. Fitt, Animal Husbandry Officer-in-Charge, Grassland Station, Marandellas, and Mr. C. A. Murray, Senior Animal Husbandry Officer-in-charge, Rhodes Matopo Estate, in carrying out these experiments.

REFERENCES.

(1) Annual Progress Report, Grassland Experiment Station, Marandellas, for the year ending 31st March, 1939.

(2) Supplementary Feeding of Minerals and Protein Supplements—C. A. Murray *et alia*, Department of Agriculture, Bulletin No. 989, June, 1936.

(3) The Feeding of Young Stock in Winter—C. A. Murray and A. E. Romyn, Department of Agriculture, Bulletin No. 1115, June, 1939.

(4) Annual Progress Report, Grassland Experiment Station, Marandellas, for the year ending 31st March, 1941 (in course of preparation).

Costs of Fattening "Rhodesia's Best" Steers, and the Importance of Compost as an Item of Profit

ON THE WITCH WEED DEMONSTRATION FARM

By

S. D. TIMSON, M.C., Asst. Agriculturist; and

G. L. BLACK, Dip. Agric. (Durham), Manager.

During the period 1st June to 14th September, 1941, 22 steers were fattened with the object of disposing of them to the Cold Storage Commission under the "Rhodesia's Best" scheme for export, and with the additional object of utilising them for making as large a quantity of compost as possible.

Steers.—The steers were purchased at £3 per head in February, 1939, as weaners of 12-14 months age, from the Central Estates, Umvuma. Their breeding was Africander-Hereford, by Grade Hereford bulls out of Africander type cows. Seventeen of them were Africander-type and the remainder Hereford-type.

From then until the commencement of feeding them on the above farm (a period of 2 years and 3 months) they were run on free range on ordinary sand veld at the Grassland Experiment Station, Marandellas. During the first winter at this Station they were given a daily ration of 1½ lbs. of whole cotton seed per head.

During the second winter half of the steers were again fed the same ration of cotton seed, and the other half received none.

The steers did well during the period at Marandellas, as is shown by the live weights prior to feeding, and this was probably partly due to the fact that they were dosed regularly

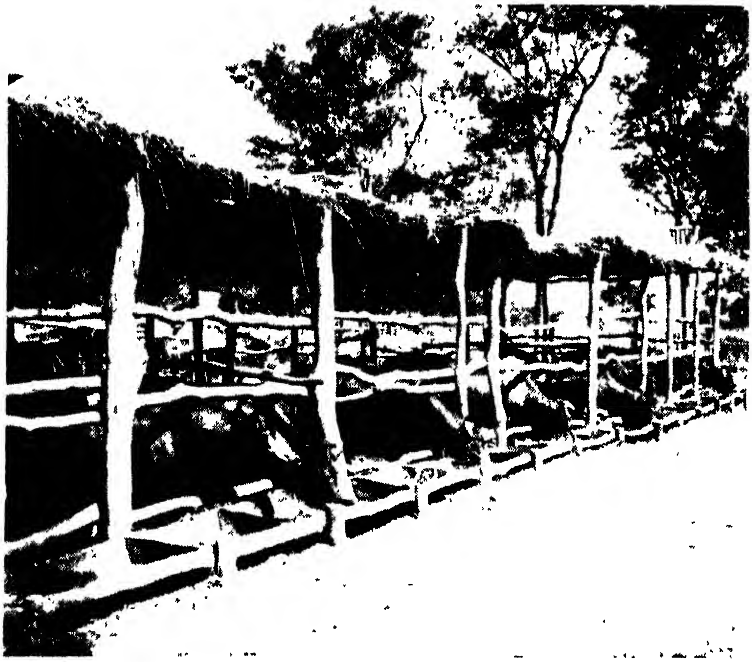
for the control of internal parasites. At the commencement of the feeding period in June, 1941, the steers were 3 years 3 months to 3 years 5 months old. The average live weight per steer on the 12th May, 1941, was 1,067 lbs.

System of Feeding.—The steers were fed the concentrate ration and legume hays twice a day, at 6 a.m. and at 4 p.m. They were watered twice at 11 a.m. and 3 p.m., the water trough being sited about 50 yards from the pens. The four pens were constructed with the feeding troughs on one side, and the rough hay rack on the opposite side, with gates on the other two sides, allowing a wagon to be driven right through the pens to facilitate removal of litter. They were 24 x 24 feet in size, and the 22 steers were divided into 4 lots, two of 5 each and two of 6 each. Light overhead cover of thatching grass was provided as protection from the sun.

Feeds.—The concentrate ration, chiefly maize, was fed in increasing quantities, commencing at 5 lbs. per head per day, and then 8 lbs., and 10 lbs., and finally 15 lbs. per day for the last period. The increases were adjusted to the appetites of the steers.

For the last eleven weeks a small ration of soya bean meal (¾lb. per head per day) was included in the concentrate ration. The silage was made from a mixture of Wintersome and Horse Gram (Dolichos biflorus), which was chopped by an ensilage cutter, and it was brownish-green in colour and slightly acid. The steers ate it freely.

The sunn hemp hay and velvet bean hay were fed (with the concentrates) as a mixture, the former being chaffed before feeding. The former was cut at 85 days from germination and was rather over-mature. It was cut by mower, tied in bundles by hand and stooked. The latter was 15 weeks old when cut. The steers showed some preference for the velvet bean hay. A rough hay made from a mixture of sunn hemp (12 lbs. per acre) with the final trap crop of Amber cane (25 lbs. per acre), and consisting chiefly of Amber cane was fed freely in the racks. It was obviously very palatable, and since it was cut when only about 2 feet high it was probably of good feeding value.



The fattening pens. The troughs were made from half oil drums.

DETAILS OF STEERS AND FEEDING.

No. of Steers: 22.

Breeding: Africander-Hereford. By grade Hereford bulls out of Africander-type cows.

Average age (approx.): 3 years 3 months to 3 years 5 months old.

No. of teeth at slaughtering: 4 x 8 tooth—17 x 6 tooth—1 x 4 tooth.

Average live weight at 12.5.41: 1,067 lbs.

Average cold dressed weight: 658 lbs.

No. of days fed: 105 days.

Date of commencing feeding: 1st June, 1941.

Grading by Cold Storage Commission: Rhodesia' Best, 14; Imperial, 8.

FEED CONSUMPTION AND COSTS.

Roughage	No. days fed	lbs. fed per day per steer	Total fed per steer	Total fed	Cost per ton or bag	Total cost
Silage	105	20	2100 lbs	18 tons	5/6	£4 19 0
V. Bean hay	"	5	525 "	5¼ "	9/6½	2 12 5
Sunn hemp hay .	"	10	1050 "	11½ "	13/8	7 17 2
Trap crop hay ...	"	ad lib		15 "	5/11½	4 9 4
Concentrates						
Maize meal ...	"	5 to 15	1100 "	115 bags	10/3	58 18 9
Soya bean meal ..	75	¾	56 "	6 "	14/10	4 9 0
Salt .. .	105	1 oz	6½ "	1 bag	7/6	7 6

Total cost of feeds		£83 13 2

Other Items of Expenditure.

Medicines	£1 18 0	
Labour and Rations:		
Attendants (210 native-days with rations) . .	7 7 0	
Carting 123 loads of bedding (65 native-days with rations)	2 6 8	
Cleanings pens 8 times (33 native-days with rations)	1 13 0	
Interest on price of steers (£157) for 4 months @ 6%	3 2 9	
Railage	4 18 0	
Insurance	1 2 0	
Depreciation on cattle pens ...	1 5 1	
		23 12 6
Total cost of feeding 22 steers (per steer £4.17.6¼)		£107 5 8

Income from Sales to Cold Storage Commission.

14 steers, Rhodesia's Best @ 45/- per 100 lbs. (average per steer £14.15.2$\frac{3}{4}$)		£206 13 3
8 steers, Imperial grade @ 35/- per 100 lbs. (average price per steer £11.11 4)		92 10 10
		£299 4 1

Expenditure.

Total cost of feeding 22 steers	£107 5 8	
Purchase price of steers: 14 at £7.10.0, 8 at 6.10 0 .	157 0 0	
Total .		£264 5 8
Nett cash profit (per steer £1 11.9)		£34 18 5

Other Items of Profit.

121 sacks containing concentrates @ 10d	£5 0 10	
220 tons of compost valued @ 10/- per ton †	110 0 0	
		115 0 10
Total profit		£149 19 3
Per steer		£6 16 4
Less estimated cost of making 10 tons compost @ 8d.* .		6 8
Total profit per steer		£6 9 8
This profit per steer is made up as follows.—		
Cash profit per steer		£1 11 9
Profit as compost and sacks recovered per steer		4 17 11

NOTES.

Grading.—At slaughtering four of the steers were 8-tooth, so that the number of possible "Rhodesia's Best" was 18, of which 14 reached this grade, the remainder being graded "Imperial," five of them on account of age.

Costs of Feeds.—These costs are the actual cost of production on the farm (operating expenses only), except for the salt and the maize meal. The cost of the maize is the Control Board price (10s. per bag) plus the cost of grinding on the farm (3d. per bag). This cost for grinding is low, since it includes no charge for the labour since the two native atten-

† Quantity estimated by measurement of heaps.
See note below on compost.

dants on the cattle did the work. The cost of cutting up the silage (7.18d. per ton), and of chaffing the sunn hemp hay (5.0d. per ton), are included in the costs given.

Medicines.—This includes Castor oil, carbon bi-sulphide for screw worm dressings, and formalin for spraying the pens which had been infected with ring-worm a year previously.

Carting and Clearing out Bedding.—123 loads of a mixture of sunn hemp and munga (the top-growth of the green manure crop) or of sunn hemp straw, were placed in the pens, which were emptied eight times during the feeding period. (See notes on compost below.) The wagon is a steel one with pneumatic tyres and is 18 feet long. It was fitted with a superstructure which allowed large loads to be carried, and the small number of oxen required allowed cheap "improver" drivers to be employed. The average haul from the field was about 1,200 yards in one case and 600 yards in the other.

THE FATTENING PENS AS A COMPOST FACTORY.

One of the two major objects in fattening these steers (the other being, of course, to make a cash profit) was to make a large quantity of compost by bedding down the steers freely and clearing out the pens at regular intervals.

The pens were cleaned out eight times at roughly thirteen day intervals, when the depth of trampled bedding was approximately 18 inches. The regular cleaning of the pens makes the work easier since forks can be used because the bedding is not so compacted, and it allows a far larger quantity of bedding to be put through the pens. Just over four native-days were required for each clearing of the pens, which had a surface area of 256 square yards. The soiled bedding was thrown over the side of the pens and moved back from the pens by fork into a large heap, which was subsequently put up into heaps 3 yards wide by 4 feet high.

These heaps have been measured, and it is estimated that the quantity of compost which will result will approximate to 220 tons, or 10 tons per steer over a period of 105 days. This is at the rate of 2.85 tons per steer per month, or over 34 tons per annum. This is a very satisfactory output, but it is considered that it can be easily increased by 50 per cent. or more, providing the bedding and labour are available, and that the wagons can be spared from other work.

Naturally at this stage the estimate of the quantity of compost must necessarily be only approximate, but the above figures are sufficiently accurate to illustrate the fact that very much larger quantities of compost per steer fattened can be made than of kraal manure. In one feeding trial of steers carried out at the Matopo Experiment Station, Murray* reports that "100 tons of excellent manure were obtained from the 151 steers" fattened. The rate of production per steer per 105 days was 0.88 ton, as compared with 10 tons of compost per steer produced in the same period as reported above. Mundy† states that he demonstrated that manure can be made by stall-fed bullocks in open pens at the rate of 3 tons in six months, i.e., 6 tons per annum. This compares with the rate of 34 tons of compost per annum per steer reached in the demonstration under review. Elsewhere Mundy has recorded rates of production with fattening cattle of 5.5 tons and of 4.6 tons per steer per annum.

The cost of carting the bedding and clearing out the kraals has been low, and on a basis of 220 tons of finished compost amounts to a charge against the compost of only 4.34d. per ton. With the ordinary wooden wagon the cost of carting would be appreciably higher owing to the need to employ more oxen and therefore more expensive drivers.

On the basis of the costs of similar work done on this farm during the past year, the cost of turning the compost to complete the work will not exceed 3½d. per ton, so that the total cost of making it should not exceed 8d. per ton‡ exclusive of depreciation on the implements employed in the work (wagon and harness, forks and mower).

It is clear, therefore, that the profit from feeding cattle can be greatly increased as compared with current practice by using the opportunity to pass as large a quantity of bedding through the pens as possible, to be made into compost. If this is done the profit from fattening cattle can be very greatly increased to the ultimate benefit of the soil. The fattening pens should be looked on as a compost factory.

* R.A.J. January, 1934.

† In "Sub Tropical Agriculture in South Africa", 1923, p.44.

‡ The cost of mowing and raking per ton cannot be given since it is not known, and is therefore not included in this figure. From the cost of similar work done previously it may be estimated at 1d. per ton of compost.

REGULATING THE PROPORTIONS OF DUNG AND BEDDING.

The now considerable literature on the subject of compost as far as is known, contains no guide to assist the farmer to judge how long he should keep a certain number of cattle on a given quantity of bedding in order to ensure that a sufficient, but minimum, supply of nitrogen in the form of dung and urine shall be present in the soiled bedding when removed from the cattle kraal or fattening pen, so as to ensure proper breakdown of the bedding when composted.

The senior author has been endeavouring to remedy this position for some time, and to find a factor which will indicate this simply. With a constant of a final depth in the kraal or pen of 18 inches of well trampled bedding, he has been endeavouring to discover the minimum number of ox-days (24 hours) per square yard of the area of a pen needed to secure the above object.

In previous cases under observation, the minimum number of ox-days per square yard, which has been proved to be sufficient so far, has been 1.20 ox-days.

In the case under review, in two of the four pens, which held six oxen each, the number of ox-days per square yard has been 1.21, and in the other two pens, which held five oxen each, the number of ox-days per square yard has been 1.01. The pens were each 64 square yards in area and were cleaned out every 13 days. With this latter figure of 1.01 ox-days per square yard it is considered that the minimum has by no means been reached; but for the time being the farmer can accept this figure as a safe basis to work on, and from this he can calculate simply how many days or nights (half-days) to keep a given number of oxen in a given size of pen.

It is perhaps advisable to point out again that the constant in this factor is a final depth of 18 inches of well-trampled bedding. If this is varied then it is clear that the number of ox-days must be varied in proportion.

It will also be clear that the minimum number of ox-days will be influenced by the original nitrogen content of the bedding materials, but the materials normally available in

quantity for use as bedding on the farm will usually be of similar low nitrogen content, such as mature veld grass, maize stalks and husks, and sunn hemp straw from the seed crop.

SUMMARY.

1. Twenty-two Steers were fattened for an average period of 105 days with the objects of making a cash profit, and also of making a large quantity of compost.

2. Of the 18 steers still young enough when finished off to qualify for the grade, 14 were graded "Rhodesia's Best," and an average price of £14 15s. 2¾d. per steer was received. The remaining 8 steers were graded "Imperial" and the average price per steer received was £11 11s. 4d.

3. The average price received for the 22 steers was £13 12s.

4. The cost of feeding the Rhodesia's Best steers (including the purchase price of £7 10s. 0d.) was £12 8s. 1½d. per steer. The cost of feeding the Imperial grade steers (including the purchase price of £6 10s. 0d.) was £11 8s. 1½d. per steer.

5. The average cash profit per steer, over all 22 steers, was £1 11s. 9d.

6. The estimated total production of compost was 220 tons. This was at the rate of 10 tons per steer for the 105 days, or at the rate of 34 tons per steer per annum.

Other workers in the Colony have previously recorded the production of kraal manure by fattening cattle at the rate of 0.88 ton per steer per 105 days; of 6 tons per annum, and of 5.5 tons and 4.6 tons per annum.

7. The profit per steer in the form of compost valued at 10s. per ton was £4 13s. 4d. on the basis of the above.

8. With a final depth of trampled bedding in the pens of 18 inches when they were cleared, the number of ox-days (of 24 hours) per square yard of pen space was 1.01 in the case of 2 pens, and 1.21 in the case of the other 2 pens.

ACKNOWLEDGMENT.

Acknowledgment is made to the Animal Husbandry Division of the Department for their co-operation and advice.

Farming Calendar.

CROPS

JANUARY.

Turn your compost heaps on a wet day. Plough under witchweed traps within two months from germination. If only one trap is being planted, plant this month. If not already sown, put in the ensilage and fodder crops at once, such as maize and legumes, Kherson and S.E.S. oats and other hay grass crops. Sow short season crops like haricot beans, linseed, buckwheat, peas, summer oats, gram and mung bean, and sunnhemp for hay. Plant out grasses and kudzu vine for pasture. Ridge potatoes and cultivate thoroughly. Main crop can still be planted. Quick growing green manuring crops, such as cowpeas, soya beans and sunnhemp, may still be sown this month. Earth up ground nuts so that a small amount of loose soil is thrown over the crowns of the plants. Cultivate all growing crops well, and thoroughly eradicate weeds. Overhaul all hay-making implements and ploughs and get in thorough repair in preparation for the haying and ploughing seasons. Endeavour to mow grass fields early for hay and litter, and to obtain second cutting for hay in April. Mow grass paddocks infested with annual weeds to prevent the latter seeding. Prevent Mexican marigold and other noxious weeds seeding by hoeing or pulling out the plants by hand. Keep a sharp look-out for maize stalk borer. Cut off the tops of infested plants or treat them with a recognised chemical preparation. Watch the maize lands for witchweed. Prevent witchweed plants from seeding by cultivation and by hand-pulling the plants. Make as much manure as possible by placing sunnhemp, grass, and litter in cattle kraals, pig sties and stables. If there is stumping and clearing to be done, push on with it.

FEBRUARY.

Continue the recommendations for January. Potatoes and ground nuts will probably need to be ridged again. Catch crops of quick maturing beans, such as tepary bean, also

buckwheat, can still be sown. Keep down all noxious weeds. This work can be undertaken on wet days. Make veld grass hay whenever a few days of fine weather permit. Early mowings provide the best hay. Keep potatoes in a cool shed, well ventilated: Pick over any potatoes in storage and remove bad ones.

TOBACCO

JANUARY.

Cultivation should be systematically continued, and no foreign vegetation allowed in the tobacco field, as weeds and grass induce insect attacks. All backward plants should be given special attention, and an additional application of fertiliser to hasten growth, so that the plants ripen as uniformly as possible. Curing barns should be placed in proper condition on rainy days, and all tobacco appliances should be placed in proper order for the rush of work during the curing season. Early planted tobacco may be ready for topping during the latter part of the month, and the common mistake of topping too high should be avoided. Go over the field carefully and select typical, uniform and disease-free plants for producing seed for next season's crop. All plants should be properly primed at the same time as the tobacco is topped. Preparation of the land for Turkish type tobacco should be completed this month and planting out commenced from the middle of the month.

FEBRUARY.

The early tobacco should now be ready for curing. Care should be taken to pick only thoroughly ripe leaf for filling the barns, so that the cured product will be uniform. Topping, priming and suckering should be given attention. Plants selected for seed production should receive careful attention. New land intended for next year should be ploughed as soon as possible, so that all vegetation turned under may be converted into humus before planting time next season.

The planting of Turkish type tobacco should be completed by the end of this month. All blanks should be refilled as early as possible after the original planting. Fields should be kept free from weeds and grass.

FORESTRY

JANUARY-FEBRUARY.

If the rains are seasonable, plant out evergreen trees, such as gums, cypress, pines, etc. Fill in all blanks as soon as they are noticed, and do not leave them until the following season. Planting should be done on a wet day or, failing that, on a dull day, or late in the afternoon. Great care should be taken to see that the trees are not planted out any deeper than they stood in the tins or beds, and that the roots are not bent in planting.

STOCK

JANUARY.

Cattle.—Put the bulls into the herd now to secure spring calves. The bulls should be in good condition at the commencement of the service season and their condition should be maintained while they are working. This season's calves should be looking well by this time and care must be taken not to over-milk the cows in consequence. Cows rearing calves should not be milked more than once a day. Bullocks which are being fattened on grass should receive a concentrate ration from now onwards; 4-5 lbs. maize meal daily should be sufficient.

During the months of December and January veld grazing is usually plentiful, and very little extra feed in the form of concentrates is required for dairy stock. It should be borne in mind, however, that heavy milking cows are unable to satisfy their requirements for milk production from veld grazing alone, and should receive a daily allowance of grain; the latter should be fed at the rate of 2 lbs. for every gallon of milk produced daily, i.e., a cow producing three gallons of milk should receive 6 to 7 lbs. of concentrates. An excellent mixture for this purpose is one consisting of four parts maize meal and one part ground-nut cake.

During wet weather, the provision of a clean dry shelter for calves is essential; the latter should not be crowded together in a small, damp, badly ventilated pen or muddy kraal. When treated in this manner, a calf is very liable to contract

various ailments such as scour, etc. Scour is entirely preventable, and is usually caused by over-feeding, or feeding from dirty pails, feed boxes, etc. Calves which contract scour should be isolated, the milk ration reduced, and they should be dosed with a few tablespoonfuls of castor oil.

Sheep.—Keep the sheep away from vleis. During this time of the year they are liable to suffer severely from internal parasites and dosing should be regular. If nodular worm is present dose twice at 30-day intervals with the new remedy.

FEBRUARY.

Cattle.—The recommendations for January apply equally to this month. Be careful that the condition of the bulls is maintained, especially in the case of well-bred animals. A bull in poor condition cannot be expected to sire a large number of calves. As far as practicable cut veld hay during this month. Usually the optimum relation of yield and composition occurs now. During this month, in addition to maize, some protein concentrate, such as peanut cake or cotton-cake will generally be necessary in the dairy cow mixture to keep up a good milk flow. Increase the grain ration to bullocks which are being fattened on grass and add some protein concentrate to their feed to make good the deficiency of this nutrient in the grazing.

Calves may be given a few hours' exercise on bright, sunny days; young stock, however, should not be allowed to run and graze with the herd, and are best kept in a cool, airy pen opening on to a small shady paddock where they can obtain a little exercise.

A good quality of sweet hay and water should always be available for young calves.

Sheep.—Continue as recommended for January. Dose regularly at 21-day intervals for wireworm and bankrot worm with the nicotine and bluestone remedy. Start putting in green food for April and May.

VETERINARY

JANUARY-MAY.

Tick life will be very active and in consequence tick-borne disease in evidence, especially redwater and gallsick-

ness, and in districts where the bont tick prevails heartwater in cattle and sheep must be expected. Regular dipping to destroy tick life and minimise losses from disease should be conscientiously carried out. Horse sickness may be expected during these months and until the first frosts appear, usually about June. Blue tongue in sheep will be prevalent in uninoculated sheep. The inoculation of sheep against this disease should not be undertaken in the wet season unless animals can be kept under cover for 21 days following inoculation, and on account of possible abortion resulting, ewes in lamb should not be inoculated. Screw worm may be prevalent.

DAIRYING

JANUARY.

Veld grazing is usually plentiful, and very little extra feed in the form of concentrates is required for dairy stock. It should be borne in mind, however, that heavy milking cows are unable to satisfy their requirements for milk production from veld grazing alone, and should receive a daily allowance of grain; the latter should be fed at the rate of 2 lbs. for every gallon of milk produced daily, i.e., a cow producing three gallons of milk should receive 6 to 7 lbs. of concentrates. An excellent mixture for this purpose is one consisting of four parts of maize meal and one part of ground-nut cake.

During wet weather, the provision of a clean dry shelter for calves is essential; the latter should not be crowded together in a small, damp, badly ventilated pen or muddy kraal. When treated in this manner, a calf is very liable to contract various ailments such as scour, etc. Scour is entirely preventable, and is usually caused by over feeding, or feeding from dirty pails, feed boxes, etc. Calves which contract scour should be isolated, the milk ration reduced, and they should be dosed with a few tablespoonfuls of castor oil.

Under the weather conditions which now obtain, cream should be despatched to the creamery at least three times a week. It is of the greatest importance that cream should be cooled immediately after separation, and should be kept cool while on the farm and whilst in transit to the railway station or siding. While the cream is being cooled, it should be frequently stirred, using a stirrer with a plunger attachment.

Warm, freshly separated cream should not be mixed with old cream which has already been cooled. Cool the fresh cream first and then mix thoroughly with the old cream. Gassiness is a common defect in the cream received at the creameries at this time of year, and is caused by gas-producing organisms with which the milk and cream are contaminated. These organisms abound in mud, manure, stagnant water, etc., and develop and multiply very rapidly at high temperatures. Any precautions therefore which may be taken to eliminate dirt, manure, etc., from the milk and to keep the cream cool will prevent the development of gassiness.

As the night temperatures are fairly high, cheese-makers should not attempt to use night's milk for cheese-making; morning's milk plus a starter will give the best results. Gouda cheese-making operations are not usually successful at this season of the year, owing to the poor quality of the milk and the prevalence of gassiness. This type of cheese is best manufactured during March and subsequent months.

FEBRUARY.

This is normally the flush season as far as dairy produce is concerned; dairy cattle are usually in good condition and cows of average capacity should be able to subsist and maintain a full flow of milk on veld grazing alone.

The cheese in the storeroom is apt to develop mould during wet weather. If the cheese is well made and pressed and has a smooth rind, this mould is merely superficial and will not penetrate into the body of the cheese. Rubbing the cheese with a cloth moistened with a weak solution of formalin or permanganate of potash usually checks the development of mould. During these months care must be taken not to use over-acid milk for cheese-making, and great care should also be taken of the starter. If this latter shows any signs of gassiness or develops any disagreeable flavour or odour it should be discarded and replaced by a fresh, clean starter. The cheese storeroom must be kept dark and flies excluded.

POULTRY

JANUARY.

All houses must be absolutely watertight, the floor raised well above the level of the surrounding ground, thus prevent-

ing water seeping in and making it damp. The birds themselves should not get wet, and no pools of water should be seen in the runs.

Foodstuffs must be kept absolutely dry, otherwise they will become mouldy and sour, causing disturbance of the intestinal tract, illness, and perhaps death; certainly a diminution in the number of eggs.

Some of the birds will now be in moult. To get them through it quickly give more sunflower seed, some monkey nuts, plenty of green food, especially cabbage, kale, etc., plenty of milk or some meat, a little sulphur in the dry mash (one teaspoonful to 1 lb.); also stew two dessertspoonfuls of linseed in a pint of water to a jelly, mix this to a crumbly consistency with mealie meal or bran and give about one dessertspoonful to each bird daily. Keep the birds dry during the rains, otherwise the egg output will decrease.

Do not hatch any more turkeys till after the rainy season is over. Turkeys should not be penned up, but allowed a free range.

Ducks must be treated in almost exactly the reverse manner to turkeys. They should be kept in a small run; nearly all their food should be wet mash, bran, pollard, mealie meal, meat meal and milk, as much as they will eat three times a day, *i.e.*, they should practically be allowed to spend their existence eating and sleeping. Big duck breeders often give a fourth meal by lamplight at 10 p.m., and the first meal is given at sunrise.

FEBRUARY.

Cockerels for future breeding should now have been selected, and those not good enough sold for killing. It is far better to get rid of all the latter, even if only at 1s. or 1s. 3d. per lb., than to keep them on, eating their heads off, in the hope of getting a better price. Those good enough for breeding, and they must be good, should be kept till about June; there is a demand for such up to this month. Any surplus at this time should be eaten or sold for what they will fetch. Of those selected for breeding purposes, the owner should keep the best one or two for his own use, with another

as a reserve. No poultry keeper should sell his best stock, no matter how high a price is offered for it.

By the end of this month the birds selected for breeding should be mated up. If it is possible, the birds selected for breeding should be given a run on free range for three weeks or so before being put into the breeding pen and fed sparingly; better fertility and better chicks will be the result. If it is possible to run the birds selected for breeding away from the others during the whole of the breeding season, all the better. Any hens that become broody should be kept broody by setting a few china eggs under them until such time as eggs from the breeders come in. Broody hens at this time and for the next five months are valuable.

During the rainy season the scratching litter must be kept dry; if it gets wet it is useless.

Duck hatching can be continued all the year round; the main points are that the young ducks must be kept out of the sun and sleep on dry grass. Nothing is more fatal to ducklings than sun, and dampness at night; and the latter applies, also, to the adults. Unless a dry shed, with a dry, soft layer of chaff or sand, etc., covering the floor, is available, it is not wise to hatch turkeys till after the wet season, for it will be labour, food and eggs wasted. If the young turkeys get wet they are almost certain to die. This and the feeding on wet mashes instead of dry food, chopped onion and thick milk, are the chief reasons for non-success in the breeding of turkeys.

VEGETABLE GARDEN

JANUARY.

Turnips, carrots, cabbages, lettuce, etc., may be sown for carrying on during the winter months. Potatoes may be planted this month for keeping through the winter. Weeding and cultivating between the rows should be continually carried on.

FEBRUARY.

Sow now—Beans, beet, cabbage, cauliflower, lettuce, peas, onions, carrots, parsnips, turnips, endive, kohl rabi, rhubarb and all herbs.

FLOWER GARDEN

JANUARY.

This month requires all one's energy in the flower garden. Annuals may still be sown for late flowering before the season is over. Planting out should be done as early as the weather permits, and advantage taken of a dull day after a shower for this work. If care be exercised much smaller plants may be put out than would at first be thought advisable, as with attention these will make stronger plants than larger ones, which are more likely to receive a check. The soil requires constant stirring, owing to the packing caused by the rains and for the eradication of weeds, which are now very troublesome. All plants should be kept free from dead and decaying matter.

FEBRUARY.

Sow carnations, phlox, pansy, verbena, gilias, larkspur, dianthus and pentstemon. The flower garden should be now looking at its best, nearly all plants being in bloom. Old and dead flowers should be constantly removed, except when the seed is required. Seeding of the plants shortens their flowering period. All runners and climbers should have constant attention, and be tied up and trained, otherwise they will be damaged by the wind. Dahlias, chrysanthemums and carnations will require staking, as they become top heavy when in flower. Make the first sowing of winter-flowering sweet peas.

Rhodesian Milk Records.

SEMI-OFFICIAL. COMPLETED LACTATIONS.

Name of Cow	Breed.	Age	Milk in lbs.	B. Fat in lbs.	Average % B. Fat.	No. of Days.	Name and Address of Owner
Sir Nels Buttercup of Shanks	P.B. Guernsey ...	Mature	6922.4	315.21	4.55	242	A. Stokes, Esq., "Safago," Gwelo
No 43	G. Friesland ..	Mature	6235.0	213.64	3.38	300	A. L. Bickle, Esq., P.O. Box 595, Bulawayo.
No. J.30	G. Friesland .	Mature	8183.7	269.66	3.30	271	
No. D 2	G. Friesland	Mature	7554.7	313.53	4.15	300	
No. 67	G. Friesland	Mature	6516.4	205.69	3.16	267	
No. J.44	G. Friesland .	Mature	6067.8	219.85	3.62	229	
No. J.37	G. Friesland	Mature	8402.0	293.39	3.49	300	
No. D.1	G. Friesland	Senior 3 yrs.	6879.4	246.41	3.58	300	
No. J.64	G. Friesland .	Junior 4 yrs.	6601.8	250.09	3.79	300	
No. J.62	G. Friesland	Junior 4 yrs	6386.0	201.08	3.15	300	
No. J.28	G. Friesland .	Mature	6084.7	242.16	3.98	280	
Alice	G. Guernsey .	Junior 4 yrs	5005.7	202.01	4.03	300	W. D. Haywood, Esq., Ordoff Farm, Gatooma.
Hartie	G. Friesland ..	Mature	8504.0	247.61	2.91	300	F. B. Morrisby, Esq., Sunnyside, Gwelo.
Linette	G. Friesland .	Mature	6871.0	251.74	3.66	300	
Stranger	G. Friesland .	Mature	10337.0	338.85	3.28	300	
No. 8	G. Friesland .	Mature	8967.0	242.34	2.70	300	
No. 9	G. Friesland	Mature	9057.0	294.44	3.25	300	
No. 36	G. Friesland	Mature	7750.0	270.90	3.50	300	
No. 21	G. Friesland .	Mature	10289.0	301.31	2.93	300	
No. 97	G. Friesland	Mature	6240.0	204.15	3.27	300	
No. 11	G. Friesland	Mature	8799.0	307.19	3.49	300	
Alma	G. Friesland ..	Junior 4 yrs	5538.7	203.55	3.68	300	T. Cousins, Esq., Oaklands, Gwelo.
Crescent	G. Friesland .	Mature	6544.2	250.02	3.82	258	
No. 359	P.B. Friesland	Mature	8572.0	309.08	3.61	300	Meikle Bros., Leachdale, Shangani.
No. 215	G. Friesland ..	Mature	7772.0	268.08	3.45	253	
No. 343	P.B. Friesland	Mature	8627.0	302.17	3.50	300	
No. 358	P.B. Friesland .	Mature	6088.0	212.20	3.49	300	
No. 20/7	P.B. Friesland	Junior 4 yrs.	6136.0	210.82	3.44	300	
No. 372	P.B. Friesland	Mature	7601.0	258.49	3.40	300	
No. 169	G. Friesland . . .	Mature	7222.0	228.71	3.17	300	
No. 193	G. Friesland ..	Mature	10239.0	366.62	3.58	300	

Flivver	G. Friesland	Mature	6153 5	217 43	3.53	266	D. J Huddy, Esq., P O. Box 899. Salisbury.
Meg	P.B. Ayshire	Mature	5979.1	244 01	4.08	244	
Mnyaga	G. Friesland	4 years	7125 4	225 35	3.16	274	
Fanny	G. Friesland	Mature	8638.5	284 05	3.29	300	
Ndegi	G. Friesland	Mature	6889.9	244 64	3.55	300	
Blossom	G. Friesland	Mature	6463 3	208.75	3 23	282	
Cherry	G. Shorthorn	Mature	6356 3	237 93	3.74	235	
No. 5	G. Friesland	Mature	7631 5	225 58	2 95	300	
No. 4	G. Friesland	3 years	5561 9	210 11	3 8	271	
Witklap	G. Friesland	Mature	7406 2	220.26	2 97	256	
Lorna	G. Friesland	4 years	6848 0	248 99	3 64	300	F Neill, Esq., P.O Box 455, Salisbury.
Addie	G. Friesland	4 years	8177 0	250.67	3.07	300	
Kanyemba	G. Hereford	Mature	6886.0	322.99	4 69	300	
Beans	G. Red Poll	Mature	5900 0	269 33	4 57	278	
Edna	G. Jersey	Mature	5933 2	250 25	4.22	254	Gower Hill Dairy, P.O. Box 1143, Salisbury.
Joyce	G. Friesland	Mature	7371 6	268.03	3 64	300	
Olga	G. Friesland	Mature	6164 7	225 05	3.65	300	
Glen	G. Friesland	Mature	7718 2	268 0	3.47	292	
Bluebell	G. Friesland	Mature	6957 8	256 68	3 69	300	
Gower Hill Marion	G. Friesland	Mature	7886.0	291 24	3.69	300	
Ingrid	G. Jersey	Mature	5156 3	253.33	4 91	300	
Ruby	G. Ayshire	Mature	5739 8	244 08	4.26	300	Mazoe Citrus Estate, Mazoe
No. 47	G. Friesland	3 years	6822.0	275 92	4.04	300	
No. 19	G. Friesland	Mature	7036 0	288 47	4.1	280	W Sole, Esq, "Bauhinia," Glendale
Lily	G. Friesland	Mature	8408 0	311 77	3 71	300	
Leone	G. Friesland	3 years	5671 9	203.65	3 59	300	
Rachael	G. Friesland	Mature	7731 0	274 86	3 56	300	H A. Day, Esq, P.O. Box 1153, Salisbury.
No. A.91	G. Friesland	Mature	6080 0	207 17	3 41	279	
No. 111	G. Friesland	Mature	6282 6	219.61	3 5	300	
No. 33	G. Friesland	Mature	5659 9	247 41	4 37	300	V A. Lawrence, Knockmaroon, Norton
Bella	G. Friesland	Mature	7309 5	216 48	2.96	300	
Immigrant	G. Friesland	3 years	5499 0	235.65	4 29	300	
Imp	G. Friesland	3 years	6480.0	207 22	3.2	300	
Clover	G. Friesland	Mature	5785 5	206 88	3 58	262	J. G Thurlow, Atherstone, Bindura.
Matapikis	G Jersey	Mature	4856 5	203.92	4.2	300	
Matisa	G. Friesland	Mature	8283 3	281.06	3 39	300	Mrs E. Lamb, P O. Box 815, Salisbury
Mazoe	G. Friesland	Mature	6618 0	227.09	3 43	300	
Nora	G. Friesland	Mature	6662 0	271.57	4 08	300	
Nyasaland	G Shorthorn	Mature	7091.0	231 45	3.26	300	Union and Rhodesia Mining and Finance Co., Ltd, Salisbury.
Dirko Rita	P.B Friesland	Mature	6264.1	210.90	3 38	271	
Martin Dorothy	P.B. Friesland	Mature	5733 9	206 36	3.6	271	
Blackie	G. Friesland	Mature	5219 8	205.21	4.0	289	
June II	G. Friesland	Mature	6425 6	211 22	3.29	279	

SEMI-OFFICIAL.—(Continued).

Name of Cow.	Breed.	Age	Milk in lbs.	B Fat in lbs.	Average % B Fat	No. of Days	Name and Address of Owner.
Bicycle	G Friesland	Mature	4750.4	243.98	5.13	240	S. Moore, Esq , P.O. Box 999, Salisbury.
Freckles ..	G Hereford	Mature	5729 3	279.15	4 87	284	
Pop	G Friesland	3 years	4249 8	201.95	4 75	281	
Little Daisy	G. Friesland	Mature	5134.0	214.20	4.17	300	
Tinker	G. Friesland	Mature	5163.1	233.32	4 52	300	
Jim	G. Friesland	3 years	5308.5	200.30	3 77	251	
Chirwendo	G. Friesland	Mature	5760 1	211 84	3.68	300	M. Huxham, Esq., Spitzkop, Mazoe.
Lorna ...	G Friesland	Mature	5796 0	242.66	4 19	300	E L Morant. Esq., Marirangwe, Salisbury
No. 122	G. Friesland	Mature	8736.0	277.57	3 18	300	Meikle Bros , Leachdale, Shangani
No. 212	G. Friesland	Mature	6745.0	245.97	3.65	297	
No. 206	G. Friesland	4 years	7898.0	251 14	3.18	300	
No. 369	P B. Friesland	4 years	7002.0	217 33	3.10	286	
No. 377	P.B Friesland	4 years	7816 0	274.77	3.52	300	
No. 361	P,B Friesland	Mature	11253.0	318.80	2.83	300	
No. 27/7	P.B. Friesland	3 years	8500.0	259.33	3.05	300	
Jennings	G. Friesland	3 years	7739.5	252.04	3.26	266	J A Baxter, Esq., P.O Box 1040, Salisbury
Ice ...	G. Friesland	Mature	5687.2	227 80	4.01	215	
Ice Cream	G. Friesland	3 years	8289 9	284.22	3 43	300	
Gilston Paulina	P.B. Red Poll	Mature	5782 8	224.11	3.88	300	G N. Fleming, Esq., P.O. Box 688, Salisbury.
Oripa ...	G Friesland	Mature	8463 6	338 44	4 0	300	W. F. H. Scutt, Esq., Maple Leaf, Norton.
Rosie	G. Friesland	Mature	6519 40	221 95	3.40	300	J R Bedford, Poltimore, Marandellas
Kerry ...	G Guernsey	Mature	5608 70	237.08	4.23	300	
Rita	G. Friesland	Mature	8116 30	339 40	4.18	300	
Betty ..	G. Friesland	Mature	5579 50	207 56	3 72	242	Boyd Clarke Estate, Castle Zonga, Inyazura.
Carpet	G. Friesland	Mature	5840 00	218 79	3 75	254	
Polly ..	G Red Poll	Mature	6053 00	235.08	3 88	300	K. M. Campbell, Hedon, Marandellas
Pamela	G. Red Poll	Mature	5339 50	200 97	3 75	300	
Gracie	G. Friesland	Mature	4793 50	209 54	4 38	300	
Doreen	G. Red Poll	Mature	4514 50	206.78	4 58	300	
No. 131	G. Friesland	Mature	5204.00	248.75	4 78	300	Coldstream Dairy, Headlands
No. 233	G. Friesland	Mature	6893 50	203 62	2 95	288	
No. 356	G. Friesland	3 years	6630 00	282.02	4 25	300	
No. 372	G. Friesland	3 years	7273 50	298 38	4 12	300	
Dulcie	G. Friesland	Mature	7806 60	254.36	3.26	300	T. Cousins, Esq., Oaklands, Gwelo.

Vera	G. Red Poll	Mature	5693 80	258.68	4 54	300	Hon H V Gibbs, Bonisa, Redbank.
Jill	G. Friesland	Mature	6545 70	237 89	3.63	300	
Lorena	G. Friesland	Mature	4957 50	207 28	4 18	300	
Grace	G. Friesland	Mature	11701.40	346 15	2.96	300	
Marlene	G Friesland	Mature	5761 40	243 65	4 23	300	
Lina	G. Friesland	Mature	6198.00	224 68	3.63	300	
Fuss	G. Friesland	Mature	5715.30	202 42	3 54	300	
Girl	G. Friesland	Mature	6241 30	213.47	3 42	300	
Dolly	G. Friesland	Mature	6361 30	236 08	3 71	300	
Shealagh	G. Friesland	3 years	5348 40	200 11	3 74	300	Captain W M Nash, Chakadenga, Marandellas.
Sharp	G. Friesland	Mature	6413 10	320 70	5 00	300	
Mina	G. Friesland	Mature	8003 00	290 05	3 62	300	F Neill, Esq., P O Box 455, Salisbury.
Jessie	G. Friesland	Mature	5831 00	212 38	3 64	283	
Mona	G Friesland	Mature	4832 00	203 74	4.22	293	F Grossman, Esq , Kenilworth, Rusape.
"P" Ebony I	G Friesland	Mature	6701.50	239 52	3 57	300	Messrs Red Valley Estate, Lushington, Marandellas
Molly II	G. Friesland	Mature	9369 80	304.46	3 25	300	
Jessie	G. Friesland	Mature	5281 30	204 51	3 87	222	
Paddock	G. Friesland	Mature	6790 30	238 63	3 51	300	
Outspan I	G. Friesland	4 years	5465 70	223 54	4 09	243	
Guinnes I	G. Friesland	3 years	7028 20	219 70	3 13	300	
Blanket II	G. Friesland	Mature	6296 50	201 00	3.19	291	W. E Tapson, Lesape Falls, Rusape.
Girida I	G Ayshire	Mature	7203 50	296 58	4 12	300	
Daisy	G. Ayshire	Mature	5785 50	253 50	4 38	300	
Susan	G Friesland	4 years	8166.00	255.23	3 13	300	W E. Tongue, P O Box 199, Bulawayo
Yeo	G Friesland	Mature	8549.00	277 26	3.24	300	
Jeanette	G Friesland	3 years	7321.00	269 76	3 69	300	
Kuku	G. Friesland	Mature	9705 00	313 26	3 23	300	
Lassie	G. Friesland	3 years	7741.00	240 66	3 11	300	
Jay	G. Friesland	3 years	6501 00	234 53	3 60	300	
Kitty	G. Friesland	Mature	11118 00	344 33	3.10	300	
Pat	G Friesland	Mature	5288.50	207 73	3 93	269	Union and Rhodesia Mining and Finance Co., Ltd , Quinnington, Salisbury.
Pansy II of Rynheath	P.B. Guernsey	3 years	3684 00	200 50	5.44	300	A F. H. Valentine, Esq , Battery Spruit, Umtali.
Mischief	G. Friesland	Mature	5564.00	269.31	4 84	300	

Southern Rhodesia Veterinary Report.

NOVEMBER, 1941.

DISEASES.

Anthrax was diagnosed on the Bulawayo Commonage, and on farm Umunwe, Insiza district.

TUBERCULIN TEST.

Thirteen bulls and thirty-five cows, heifers and calves were tested on importation. There were no reactors.

The Matopos Experimental Station herd was tested during the month. The one reactor will be destroyed.

MALLEIN TEST.

Thirteen horses and twenty-seven mules were tested on importation with negative results.

IMPORTATIONS.

Union of South Africa.—Bulls, 13; cows, heifers and calves, 36; horses, 13; mules, 27; sheep, 2,101.

Bechuanaland Protectorate.—Sheep and goats, 45; pigs, 40.

EXPORTATIONS.

Bechuanaland Protectorate.—Bulls, 12; pig, 1.

Northern Rhodesia.—Bulls, 6.

Union of South Africa: Horses, 12; mules, 1.

EXPORTATIONS—MISCELLANEOUS.

In Cold Storage.

United Kingdom.—Beef quarters (chilled quality), 152; pork carcases, 228.

Northern Rhodesia.—Beef carcases, 198; mutton carcases, 36; pork carcases, 19; veal carcases, 1; offal, 10,764lbs.

Belgian Congo.—Beef carcases, 55; pork carcases, 30; offal, 493lbs.

Meat Products from Liebig's Factory, West Nicholson.

Union of South Africa.—Corned beef, 292,032lbs.; tongues, 408lbs.; ideal quick lunch, 1,416lbs.; meat paste, 5,953lbs.; beef fat, 400lbs.; assorted beef rolls, 3,440lbs.; ham and tongue rolls, 2,476lbs.

Northern Rhodesia.—Meat meal, 6,000lbs.; bone meal, 6,000lbs.

United Kingdom.—Beef powder, 3,346lbs.

Mauritius.—Tongues, 960lbs.; meat paste, 219lbs.; assorted beef rolls, 858lbs.

Portuguese East Africa.—Corned beef, 288lbs.; tongues, 72lbs.; Vienna sausages, 321lbs.; ideal quick lunch, 72lbs.; meat paste, 29lbs.; assorted beef rolls, 150lbs.; ham and tongue rolls, 15lbs.

B. A. MYHILL,
Chief Veterinary Surgeon.

SOUTHERN RHODESIA

Locust Invasion, 1932-41.

Monthly Report No. 108. November, 1941.

RED LOCUST (*Nomadacris septemfasciata*, Serv.).—Swarms were reported in the following districts, namely:—Darwin, Mazoe, Melsetter (Chipinga), Ndanga, Chibi and Nyamandhlovu. Ndanga reported "two large swarms" and Chibi "several large swarms."

There appears to have been a westerly movement of a few large swarms, one from Portuguese East Africa through Darwin district, and others, possibly, from the eastern border in Chipinga sub-district, where swarms have been present for some months past, to the Ndanga and Chibi districts.

Specimens examined at Salisbury were not yet in breeding condition.

RUPERT W. JACK,
Chief Entomologist

Sales.

AGRICULTURAL EXPERIMENTAL STATION, SALISBURY.

SPINELESS CACTUS SLABS.

Delivery during September and October ... ... 100 slabs 7/6
Delivery during other months ... ... 100 slabs 12/6
(not recommended).

Varieties: Algerian, Muscatel and Nopalea.

KUDZU VINE CROWNS.

Delivery during September, October (for irrigated land).
January for "dry land" ... ... per 100 crowns 15/-

SWEET POTATOES.

Tubers- Delivery during September and October.
7/6 per 75 lbs.

Cuttings—Delivery during January ... ... 6/- per bag.

Varieties: Virovsky, Early Butter, Linslade, Calabash Leaf.

EDIBLE CANNA TUBERS ... ... 6/- per 75 lbs.

GRASS ROOTS.

Delivery during January ... ... 6/- per bag.

Varieties: Woolly Finger, Swamp Couch, Creeping False Paspalum, Naivasha Star and Panicum Makarikari.

Napier Fodder ... ... 10/- per bag of 200 roots.

Cow Cane ... ... 10/- per bag of 200 roots.

The above are available in limited quantities only.

Owing to pressure of other duties and wartime reduction of staff deliveries cannot be guaranteed at times other than those stated, and living plant material cannot be sent beyond the borders of this Colony.

All the above will be delivered free by rail to any station or siding in Southern Rhodesia, but the price does not include Road Motor Service charges. Cheques should be made payable to the Accountant, Department of Agriculture and Lands, and preliminary enquiries and subsequent orders should be addressed to the Agriculturist, Department of Agriculture, Salisbury. (Sept.-Jan.)

THE RHODESIA
Agricultural Journal

Vol. XXXIX.]   No. 2   [March - April, 1942

Editorial

Notes and Comments

Dairying and the War Effort.

The necessity for reducing the importation of foodstuffs involving sea transport and for increasing the Colony's supply of milk, butter and cheese was emphasised by Mr. J. R. Corry, Chief Dairy Officer, in his recent broadcast to farmers. The greatest need was creamery butter and not farm butter; creameries are fully equipped for the manufacture and proper storage of butter, and prices paid by them for butterfat, including the bonus usually distributed annually, are now as high, if not higher, than those paid in any part of the world. A war subsidy of one penny per pound on all 1st and 2nd grade Cheddar cheese and small Gouda cheese will be paid by Government as from 1st February this year. The payment will be passed to the producer by the factory or creamery, but it will not affect the wholesale or retail prices of dairy products nor will it apply to farm butter.

Increased production can be brought about in several ways but chiefly by improving the feeding methods and by feeding cows to full milking capacity. Dairymen should grow as much feed as they can, particularly legumes which are almost irreplaceable for feeding milking cows. A method which has given good results during the past year at Rhodes Matopos Estate, near Bulawayo, consists in keepinig cows in yards or pens similar to those used for fattening bullocks, and is suitable for farms where there is little or no winter grazing. Roughage such as hay should be fed in the pens, which should be well provided with bedding, and under natural shade if possible. The cows should be taken out only for milking and watering; there are no long treks for grazing of poor quality, and the animals keep their condition

better in the open air. Moreover the mixture of bedding, manure, feed, etc., collected from the pens is a valuable addition to the compost heap. The method is certainly worth a trial. Dairy farmers now have a chance, while helping themselves, to make an important material contribution to the Colony's war effort. We feel sure that they will not fail to respond to this appeal.

Compost.

It is satisfactory to note a large increase in the total quantity of compost made during 1941 as compared with the previous year, but under the present conditions of increasing fertiliser prices and a possible shortage in supplies, farmers are urged to make every ton of compost they can in order to maintain and increase the production of their soils. The use of compost will, in most cases, make it unnecessary to apply nitrogenous or potash fertilisers to their crops, and will greatly economise phosphatic fertilisers since reduced quantities may be employed. At the same time the humus in the compost will confer benefits on the soil, which artificial fertilisers cannot supply, such as the maintenance of the all-important crumb structure of the soil on which the tilth depends. It may be said that the war has made it a national duty for the farmer, as well as a duty to himself, to make the greatest effort to increase his production of this most valuable source of soil fertility.

COMPOST.

District.	Total amount made cub yds. 1940.	1941.	No. of farmers making it. 1941.
Nyamandhlovu	2,650	7,607	14
Bulalima Mangwe	878	1,280	9
Matobo	1,755	448	7
Umzingwane	—	1,549	13
Bulawayo	2,730	5,812	23
Bubi	4,270	1,623	14
Gwelo	10,157	10,276	43
Selukwe	1,220	2,283	10
Insiza	2,038	4,276	17
Gwanda	50	310	2
Belingwe	1,000	100	1
Matabeleland	26,758	35,564	153

District.	Total amount made cub yds.		No. of farmers making it.
Victoria	1,388	1,952	17
Chilimanzi	3,541	1,562	10
Hartley	23,178	73,696	71
Lomagundi	17,223	19,941	75
Mazoe	22,046	31,107	86
Salisbury	35,732	40,636	120
Marandellas	6,921	3,803	36
Charter	536	420	4
Gutu	251	1,500	8
Ndanga	1,468	3,450	3
Melsetter	1,084	3,145	16
Umtali	4,354	4,813	39
Makoni	1,713	12,850	24
Inyanga	1,704	370	6
Mrewa	1,050	1,840	3
Darwin	10	78	3
Mashonaland	122,201	201,163	521
S. Rhodesia	148,959	236,727	674

Largest single producers:—

4.300	14,000 cubic yards.
4,000	8,000 ,, ,,
3,000	5,400 ,, ,,
	5,000 ,, ,,
	5,000 ,, ,,
	4,800 ,, ,,

Note.—Two cubic yards of compost may be taken as weighing approximately one ton.

Tobacco Fertilisers.

The Editor, *Rhodesia Agricultural Journal.*

It is now some years since Dr. Nierenstein stressed the advisability of using soya meal as part or all of the source of nitrogen in tobacco fertiliser. One of the reasons he gave

was that it contained the enzyme urease which was able to break up the linkages N.H. and C. in the proteins and render the nitrogen quickly available to the plant.

Last mail I received a letter from Dr. Hugh Nicol, of the Imperial Bureau of Soil Science, to whom I wrote on such problems. He replies "The use of soybean meal as a source of nitrogen in tobacco fertiliser is rapidly extending in the Connecticut Valley. It gives an effect similar to that of cotton seed meal, which has long been in use, but has been experimentally shown to give better quality than does the latter." And again "You will be interested to learn that in parts of the United States where cotton seed cake has long been used in conjunction with inorganics as a fertiliser for tobacco still better results have been obtained by substituting soya bean cake for all or part of the cotton seed cake."

Speaking of "complete" fertilisers, he says such "completeness" is now being fairly widely questioned—some fertiliser people do not now regard a fertiliser as complete unless it contains a proportion of minor or trace elements."

In the November number of the Journal you gave two methods of treating bones. If, in the second method, you substitute human for animal urine and add considerable quantities of this you will get an extremely valuable substance rich in plant growth substances. I find that by putting a few old dip drums in suitable places and paying a native an extra shilling per week all this otherwise waste product can be put into the bone heap. Cover the heap as is done in making charcoal, with some inches of soil, and each morning make a hole in a different place and pour in the liquid, covering up the hole again.

All my nitrogen in my tobacco fertiliser this season was derived from ground nut and soya meal. To this was added bone meal, a little muriate of potash and ground compost which had been well saturated in human urine. I claim this to be a complete fertiliser and to be more suitable for the tobacco plant than the ordinary commercial fertilisers. As the Trelawney Research Station are trying some of this out, we can look forward to their report with interest.

The main point, Mr. Editor, is that the bulk of this mixture can be produced in the country, that it is going to give a very much extended market for two products of the mixed farmer when its use becomes general, as surely it will when we can get growers to try it.

J. M. MOUBRAY.

Chipoli, Shamva, January 15th, 1942.

We are pleased to publish this letter from an experienced farmer whose enthusiasm for improved methods is so refreshing. Captain Moubray's remarks, however, call for several comments. We consider soya beans to be much more valuable for stock feed under existing circumstances than for use in manures or fertilisers, and there is no doubt that they will be used increasingly in the production of nutritious foods for human consumption, owing to their richness in proteins and vitamins. Moreover, there exist other organic substances such as hoof and horn meal, unsuitable for use in foodstuffs, which may be used as a source of nitrogen in manures. As our correspondent has mentioned, experiments have been carried out at the Tobacco Research Station, Trelawney, with organic substances as manures, and results will be awaited with interest by farmers generally. Also, with regard to the "complete" fertiliser described in the penultimate paragraph of the letter, it does not appear that a proper balance, in relation to phosphates and potash, has been established.

Chemical analysis will indicate the presence and extent of an excess of nitrogen.

Pedigree Pig Breeders' Association.

We welcome the formation of the Pedigree Pig Breeders' Association of Southern Rhodesia, the objects of which are to promote the welfare and improvement of pig breeds in Southern Rhodesia, by propaganda, by conducting sales and shows, by organising or supporting recording schemes and by taking such steps as may be decided upon to improve the breeds in Southern Rhodesia in conformity with the standards

laid down by the responsible bodies in the country of origin; to safeguard the interests of bona fide pedigree pig breeders and to represent their views within Southern Rhodesia. Captain the Hon. F. E. Harris, Minister of Agriculture and Lands, is President. Mr. J. Trinder, P.O. Nyamandhlovu, is the Honorary Secretary, from whom further information may be obtained. The Association is affiliated to the National Pig Breeders' Association of Great Britain, and the Large Black Pig Society. It is recognised by the Pig Breeders' Society of South Africa, and has received a grant from this body.

ERRATA.

Vol. XXXIX., No. 1 (January), page 8, paragraph 4: *for* "100 lbs." *read* "10 lbs." (ten pounds); paragraph 5: *for* "three to four sackfulls" *read* "three-fourths of a sack-full."

Tobacco Culture in Southern Rhodesia.

HARVESTING AND CURING VIRGINIA TYPE TOBACCO.

By D. D. Brown, Chief Tobacco Officer.

The value of tobacco is dependent upon quality and, unless proper care is exercised during the harvesting and curing stages, the financial return to the grower may be seriously reduced through lack of quality in the cured leaf. Mistakes in either operation cannot be rectified when once they are made. The question of quality is of primary importance, and it will become increasingly so with the growth of intensive competition with other tobacco-growing countries.

Ripening Stage.—The young tobacco plant, when growing vigorously, carries leaves of a deep green colour, which at this stage are soft and pliable. This dark green colouration is a sign of a plentiful supply of nitrogenous constituents, which go to make up the living or vital parts of the leaf, and which are necessary for the building up of the food supply of the plant.

At about the time the leaves as a whole have reached their maximum power of elaborating the food supply, the flower head begins to develop. This food supply, consisting of starch and other substances, is carried from the leaf into the seed head to furnish the necessary food for the development of the seed. Then, having fulfilled their purpose, the leaves pass naturally into the period of gradual decay.

In practice, however, the terminal bud is removed from the plant to prevent the development of seed. Making a last effort to reproduce itself, the plant then sends out secondary shoots or suckers, but these, too, are removed by the grower. Thus translocation of the food material from the leaves to

other parts of the plant is arrested and both the size and body of the leaf are increased. The surplus food supply which accumulates in the leaf also induces ripening and, later, unless the leaves are harvested, gradual decay.

Actual and personal experience is required before the grower is fully able to determine when tobacco leaf is properly ripe, but the following description may prove helpful.

Normally the crop will start to ripen approximately ninety days after the date of transplanting. The lower leaves ripen first and the top leaves are the last to reach maturity. The first indication of ripeness is a change in the colour of the leaf, provided this change is not caused by conditions other than maturity of the plant. In seasons of severe drought or excessive rainfall, the leaves will often turn yellow before the plant is fully ripe. Plants affected by disease will also change colour prematurely; root-knot nematode is another common cause of this condition. The leaves of plants thus affected fail to cure properly, and lack the necessary quality.

The dark green colour of healthy, light-bodied leaf gradually changes to a greenish yellow as the tobacco reaches maturity. In the case of heavy-bodied leaf, the yellow may appear only in flecks or spots and the tip of the leaf curls down and in towards the stalk of the plant.

The accumulation of starchy materials in the leaf causes it to become thick, brittle and the surface rough; this change from being pliable and smooth to the touch is another sign of ripeness. Such leaf will crack when folded and pressed between finger and thumb.

Speaking generally, the higher up the stalk the leaves are, the more pronounced the change in colour and the general signs of ripening must be before they are ready for harvesting. Furthermore, the heavier the leaf, the riper it should be before picking. The number of leaves ready for harvesting varies according to the plant. Generally, however, from two to four leaves per plant reach maturity about the same time.

Successful curing of tobacco requires a combination of good judgment and careful workmanship. Much of the

success in curing depends on harvesting the tobacco at the right time, when it is neither too ripe nor too green. The degree of maturity, however, which the tobacco should attain varies according to type and the method of curing employed. The correct degrees of ripeness necessary to secure the best results in each method are:—

Air curing.—Almost fully ripe leaf.

Sun curing.—Almost fully ripe leaf.

Flue curing.—Fully ripe leaf.

Fire curing.—Fully ripe leaf.

Harvesting.—Tobacco may be harvested by cutting down the whole plant or by the removal of individual leaves. The former method is employed principally in the case of sun-cured, air-cured and fire-cured tobacco. It is an economical method as regards labour requirements but has the drawback that all the leaves on the plant are not in the same state of ripeness when harvested; also there is an increased loss in the weight of the leaf during the curing process. When harvesting by the whole plant method, it is advisable to use a suitable knife to split the stalk down the centre to within about six inches of ground level. Then, the plant being held slightly down and away from the operator, a slanting cut severs the stalk from the root. The plants are then allowed to wilt slightly, after which they are placed astride the curing sticks. One such stick will hold from six to ten plants, depending upon their size. The sticks, when filled with their complement of plants, are next placed on a trolley and conveyed to the barn or curing racks, as the case may be. Tobacco should be carefully handled, otherwise the leaves may become bruised and damaged.

Flue-cured tobacco is harvested by the single leaf or "priming" method, as this system has proved to be particularly suitable and renders easier the filling of the barn with leaf uniform in ripeness and texture. This method is now generally adopted also in the harvesting of sun-cured, air-cured and fire-cured tobacco in Southern Rhodesia. Usually the number of pickings required to complete the harvest is from three to six, depending on the growth of the plants. By this means, leaf of uniform ripeness is picked and then

placed either in crates, baskets, "machilas" or sleighs specially constructed for the purpose. A very suitable receptacle made and used by many tobacco growers is manufactured from ordinary bush poles and hessian. The frame is made of poles (about three inches diameter), the two top members being six feet long and extending about twelve inches beyond the ends of the crate and serving as handles. For convenience in stowage, the fixed handles might be replaced by detachable poles. These are passed under the top cross-bars at either end and held in position by wire loops fixed at the four top corners. One set of such handles will serve for a number of these crates. A similar arrangement can also be applied to the iron crates manufactured and sold by local firms. Laths are placed across the bottom of the framework to prevent the hessian from sagging when the crate is filled with leaf. The sides and ends are stayed diagonally with heavy guage wire. Hessian is sewn to the inside of the framework to cover the bottom, sides and ends of the crate. A loose flap is also sewn along the top of one side and used to cover the tobacco and protect it from sunburn. The average crate is 4 feet long by 2 feet wide by 2½ feet deep.

These crates are carried about the field and, when filled, are loaded one on top of the other on a wagon or lorry. One or two crates may be placed on a sleigh for transport to and from the field. This method, however, is not generally recommended because of soil erosion resulting from sleigh tracks.

During harvesting and stringing operations the tobacco must be carefully handled to avoid bruising or tearing the leaf.

The containers holding the tobacco are next carted to the stringing shed where the leaf is carefully removed and placed on tables or on the floor within easy reach of the natives employed in tying the leaf on to sticks. During the tying process, the sticks are supported on racks formed by posts let into the floor at intervals of about four feet and extending some three feet above floor level. The tobacco is strung in bunches of from two to five leaves, depending on their size, and in each bunch the leaves are placed back to

back or midribs towards the centre. When dealing with large, heavy leaf, only two leaves are placed in each bunch, and in the case of small, light-bodied tobacco, the number is increased to four or five leaves per bunch.

Sail twine or soft string is used for tying the tobacco, one end being securely fastened to an end of the stick before the operator commences to deal with the leaf. When tying tobacco, the string should be wrapped approximately one and a half inches below the leaf butts. Placing the string lower than this results in bruising and discolouration of the base of the leaves. The string is held in one hand and, with the other, a bunch of leaves is placed in position close to the stick. The string is then wound one and a half times round the leaves before the bunch is turned and slung over and across the stick to complete the operation. The next bunch of leaves is hung on the opposite side of the stick and about three inches in advance of the last bunch. Thus the bunches are staggered down the length of the stick and the weight of the leaf is supported by the string zig-zagging along the top of the stick.

When the stick is filled with tobacco—generally thirty-two bunches of leaves—the free end of the string is wrapped round and tied to the end of the stick, which is then ready for the barn or curing racks, as the case may be.

In cured tobacco the colour, texture and quality of the leaf are the important features. When harvested before the proper time the leaf will retain a green colour and be of little or no commercial value. If picked when over-ripe, the colour will be uneven and blotchy, and the texture harsh and lacking quality.

For flue-cured tobacco especially it is essential that the barn should be filled each time with leaf which is uniform in ripeness, body and texture. If tobacco in different stages of maturity and varying in body and texture is placed in the barn, there will be a corresponding variation in the curing rate of the leaf, and lack of uniformity in the cured product. Close personal attention to these details is required from the grower if a frequent cause of serious loss is to be avoided.

Curing.—Curing is an essential and important phase in the production of tobacco and is the descriptive term applied to the process by which the newly harvested leaf is first coloured and then dried. There are several methods of curing tobacco, namely, air-curing, sun-curing, fire-curing and flue-curing. The purpose for which the leaf is to be used, as well as the soil and the climatic conditions under which the crop has been grown, largely determines the method of curing. Although these methods differ in some respects, there are certain basic principles which are common to all.

Heat and moisture are the principal factors controlling the process of gradual starvation which the leaf is forced to undergo in curing. Curing is largely a physiological process and the principal changes in composition must therefore be brought about before the leaf is killed. The surplus supply of food stored up in the leaf during the ripening period enables it to live for several days after harvesting.

When harvested, mature leaf is estimated to contain approximately 80 per cent. of water, most of which is lost during the curing, when it is gradually expelled from the tissue of the leaf. Certain chemical and physiological changes also occur which bring about those desirable qualities found in properly cured tobacco. These changes in the composition and character of the leaf, which take place during the curing, are not yet fully understood.

The rate of drying has an important effect on the result of curing. If the leaf is dried out too rapidly, it is killed prematurely and the curing ceases. On the other hand, if the rate of drying is too slow, the curing is prolonged. In either case the tobacco will be spoiled, firstly by remaining green in colour and harsh and lifeless in texture, and secondly by being "sponged" and lacking in quality.

Air-Curing.—This method of curing is the simplest, and is very extensively employed; a great part of the world's tobacco supply is thus cured. Air-curing is a natural process, for the tobacco is harvested and placed in the barns to be cured under ordinary atmospheric conditions. The results

are dependent almost entirely upon climatic conditions obtaining during the curing period. If conditions are suitable and proper care has been taken in harvesting, the leaf will cure out well.

In order to overcome the effects of unfavourable weather during the curing, growers have in recent years introduced artificial means (heat and moisture) which somewhat modify the process.

When an excessively hot, dry spell sets in immediately after the tobacco is placed in the barn, the leaf may be killed prematurely, which results in undesirable colour and lack of quality coupled with a serious reduction in value. On the other hand, when wet weather occurs, heavy loss may be caused through "pole-sweat," and the colour and quality of the leaf may be adversely affected. The ideal climatic conditions for air-curing are clear, calm days, moderately dry atmosphere and a temperature of 80° to 90 F. in the shade. Under these conditions the moisture given off from the leaf is readily absorbed by the atmosphere, oxidation is reduced to a minimum and the tobacco cures moderately bright in colour. The occurrence of wet weather during the final stages of curing and before the removal of the tobacco from the curing shed, will cause the leaf to turn red.

The time generally required for air-curing is from six to twelve weeks, depending on the nature of the tobacco and the climatic conditions prevailing during the curing. When the single leaf method of harvesting is employed, the tobacco will cure in less time than would be required in the case of curing the whole plant.

Normally, all leaf should turn yellow before it begins to dry out. If it dries before yellowing, the leaf will remain a green colour and be of small value. When drying is delayed too long after the yellowing, oxidation takes place, causing the colour of the leaf to change to red or brown.

The purpose for which it is to be used determines, in a large measure, what the desired colour of the leaf should be and the curing should be arranged accordingly. For the

manufacture of cigarettes, lemon yellow to light orange-coloured leaf is required, whilst leaf for pipe mixtures, plugs and twists will range from light red to dark brown. In the case of cigar tobacco, the requisite colours are shades of brown and olive.

When filling the curing shed, the sticks of tobacco are hung up on tiers, starting from the topmost tier and working down to the lowest. Much damage may be caused by placing sticks, holding the entire tobacco plant, in the wrong order. Any one tier should not be filled before another is commenced. The correct procedure is first to place one stick on the highest tier, then the following stick on the next tier down, with the butts of the tobacco plants just touching the tips of the plants suspended from the stick above. The next stick is then hung on the third tier down and placed in similar relation to the stick above, as indicated in the case of the first and second sticks. This order of filling is continued until the bottom stick has been suitably placed on the last tier, when the same order is observed by commencing again at the top and working downwards as before. This is continued until one section or "room" is filled. Each section is completed in proper sequence until the barn is fully packed. The filling of a barn should be commenced at a point furthest from the door, leaving the section by the door until last.

At first the tobacco sticks are placed along each tier at intervals, which allow the plants to touch, but not come in too close contact. The usual spacing is about six to eight inches, depending on the length and girth of the plants. Later on, when the tobacco is sufficiently yellowed in the barn, the spacing between sticks may be increased in order to hasten the drying of the leaf. During excessively dry weather, the sticks of tobacco should be kept closer to prevent the leaf drying out too rapidly, and to enable it to turn a suitable yellow colour.

The atmospheric conditions in the barn should be so controlled that the relative humidity is fairly high during the wilting process, the wet bulb of the hygrometer registering between $2\frac{1}{2}°$ and $3°$ below the dry bulb. If the difference in the reading between the wet and the dry bulbs be greater

than 3°, more moisture should be introduced into the barn. On the other hand, if the difference is less than 2½°, the humidity must be reduced by ventilation or by heating. The temperature of the barn should be maintained at from 70° to 75° F. during the wilting process. When the tobacco has changed to a pale greenish-yellow colour, the temperature should be increased to 80° F. and then to 90° F. The relative humidity should be decreased in order to allow the leaf to commence drying. Care must be exercised at this critical stage in the curing, otherwise the tobacco may be spoiled either by drying too quickly and remaining green, or through excessive moisture and delayed drying causing sponging and, in extreme cases, pole-sweat.

After the leaf has yellowed, the rate of drying should be gradually increased by use of ventilators. In barns fitted with flues the curing may be hastened by lighting the fires.

It is possible also to combine the air-cured and sun-cured methods. The tobacco is first placed in the air-curing barn and is wilted and yellowed in the usual manner, after which it is removed from the barn and the curing process is completed by sun-cured methods. The partly cured tobacco is conveyed to the curing racks, where it is exposed to the direct rays of the sun until the leaf is thoroughly dried out. After the tobacco is fully coloured and dried, it should be carefully removed from the racks. Over exposure to the sun will result in undue bleaching of the leaf.

Speaking generally, climatic conditions during the early part of the season are not conducive to good results and if air-curing were to be properly developed in Southern Rhodesia, it would be necessary to use suitable air-curing barns. In other countries where this method of curing is practised, the barns are both elaborate and costly. The erection of grass sheds in which the tobacco is more or less exposed to the elements, cannot be recommended and the results are likely to prove disappointing.

Sun-Curing.—Sun-curing is similar to air-curing in that no artificial heat is employed. In other features, however, it differs. The rate of curing is accelerated by exposing the leaf to the direct rays of the sun, whereas in air-curing the rate is primarily regulated by atmospheric conditions.

In addition to a packing shed, bulking shed and conditioning pit (all of which are required on any farm where tobacco is produced), a wilting shed and curing racks are necessary equipment.

The wilting room is used for yellowing the leaf before the tobacco is placed out on the racks for drying. This room or shed should be kept fairly dark and cool and have ventilation facilities for the control of temperature and humidity. Besides serving as a wilting room, the building may also be used for conditioning the cured leaf.

The drying racks are constructed from native timber and heavy guage galvanised wire. These racks should be erected on a well sheltered site, having a good exposure to the sun and being reasonably close to the field and buildings.

For sun-curing, the tobacco may be reaped either by the whole plant or by the single leaf or "priming" method. The latter method is now generally preferred in this Colony. The usual practice followed in sun-curing is to harvest the leaf just before it is fully ripe. The tobacco is then strung on sticks and placed in the wilting room, where it remains until the leaf turns a greenish yellow. When the leaf is properly yellowed, it is removed from the wilting room and placed on the drying racks. The tobacco remains on the racks, exposed to the direct rays of the sun, until both the web and midrib are thoroughly dried out. The time usually required for sun-curing is from four to six weeks.

During this period some covering for the tobacco is required during the night and, in the event of rain, during the day. For this purpose grass or reed mats or grass hay have proved suitable. After the tobacco has been on the racks from four to six weeks, it should be ready for removal to the conditioning pit preparatory to bulking. The removal of the cured tobacco from the racks should be effected, if possible, either during misty weather or early morning before the heat of the sun dissipates the moisture absorbed by the leaf overnight. A great deal of damage may result from handling the leaf whilst it is dry and brittle. It is usual, therefore, to wait until the leaf absorbs sufficient moisture from the atmosphere, when conditions are favourable, before removing the tobacco from the curing racks.

Where it is absolutely essential to have the racks cleared within a certain time, growers may sometimes resort to the expedient of taking down the sticks from the racks about sundown. The sticks are placed flat down on the grass and the tobacco is left fully exposed to the dew overnight. The leaf will then be soft enough for handling by sunrise the next morning. Should the dew be heavy, the tobacco will lose colour through becoming wet. This practice is, therefore, not recommended, except in cases where the removal of the tobacco within a certain time is imperative.

The sun-curing method can be recommended where the soil and climatic conditions are suitable only for the production of a heavy type of tobacco.

Sun-cured tobacco differs somewhat from air-cured leaf, and possesses certain desirable qualities. It is usually lighter and more uniform in colour and is sweeter and more aromatic. This type of leaf is used for chewing tobacco and pipe mixtures.

Fire-Curing.—This method calls for the use of fire during the curing process. Heat is furnished by means of open fires made in shallow pits or trenches dug in the floor of the barn. The smoke from the burning wood imparts a creosotic flavour and distinctive aroma, besides improving the keeping qualities of the tobacco. Leaf for fire-curing must be fully ripe and may be harvested either by the whole plant or by the "priming" method. The tobacco is hung in the barn in similar manner to that already described for air-curing and sun-curing. The sticks are placed at intervals of from six to eight inches along each tier. The tobacco is then allowed to hang for four to seven days, during which time the leaf should yellow. After four to seven days, when most of the tobacco in the barn is yellow, small fires are lighted in the trenches dug in the floor, and the temperature of the barn is gradually increased to about 100° F. This temperature is maintained until the tips and edges of the leaf begin to curl and turn brown, when the fires are put out and the barn allowed to cool down. This will allow the sap to run back into the leaf, and the brownish parts of the leaf to become pliable. The fires are then re-started and the temperature raised to a few degrees higher than during the preceding stage.

When the brown colour begins to spread from the edges towards the midrib and the brown coloured part of the leaf becomes brittle, the fires are again removed and the barn allowed to cool and the sap to spread. This process is repeated, and as the curing progresses, the temperatures are increased each time after the fires are re-lighted. It is seldom advisable to raise the temperature higher than 125° F. The cured leaf should be of good size and body and a uniform dark brown colour.

The desired qualities of the cured leaf may be seriously affected by being subjected to excessive quantities of smoke, which will leave heavy deposits on the leaf and blacken the tobacco. The fuel used for burning in fire-curing barns should be selected from hard woods which do not create any unpleasant smell whilst burning. Shelled maize cobs also form a suitable fuel.

After the curing is completed, the tobacco is brought into condition and bulked preparatory to grading and baling. The time taken for fire-curing is between two and three weeks, according to the size of the tobacco and seasonal conditions during the curing period.

Flue-Curing.—In flue-curing, artificial heat is applied continuously throughout the curing period. Heat is generated in the furnaces by means of wood fires, and flues radiate this heat into the barn. Coal may also be used in suitably constructed furnaces. There are also special curing systems employing oil burners, steam radiators and electric radiators, which dispense with the use of the conventional flues and provide more accurately controlled heating.

Flue-curing is the most modern method of curing tobacco and requires constant and careful attention to every detail. The skill and care exercised during the curing have a direct influence on the value of the tobacco produced. Typical flue-cured tobacco ranges in colour from bright yellow to dark brown. Clear lemon coloured leaf, however, is in the greatest demand and commands the highest prices. Green is the colour least desired, and the curing should be so regulated that the proportion of green coloured leaf is kept at a minimum. Care in harvesting the tobacco will assist in reducing the quantity of green-coloured leaf in each curing.

On the other hand, the leaf should not be fully yellow when it comes from the barn. It is found that the most successful curing and clearest colours are generally obtained when the leaf is dried out with a slight green tinge. For a uniform curing of good colour, a first requirement is that the barn be filled in one day with leaf of the same texture and ripeness. The tobacco will then yellow at practically the same time and cure evenly. *There are many formulæ advanced for this method of curing, and any one may be correct under certain conditions, but they cannot all be correct at one and the same time.* The type of leaf and the climatic conditions obtaining during the process will largely regulate the rate of curing; for instance, heavy-bodied leaf will be longer in curing than light leaf, and leaf which is yellow when picked will cure faster than green-coloured leaf.

In order to control the rate of drying, the temperature in the barn must bear a certain relation to that of the outside air. The correct difference between the temperature inside the barn and the air outside will be determined by the humidity of the latter. The moisture holding capacity of air increases as the temperature rises, consequently higher temperatures are required in the barn during wet weather than in dry weather, and lower temperatures are required in cool weather than in warm weather.

The state of the outside air has also to be considered in regulating the ventilation of the barn during the time the tobacco is being cured. A dry outside atmosphere calls for reduced ventilation through bottom ventilators, and top ventilation should also be reduced to a minimum so that the leaf will not dry out too rapidly and too green. In wet weather the bottom ventilation is reduced and top ventilation is increased in order to expel moisture-laden air from the barn.

During excessively wet spells, and when the leaf is heavy bodied and contains a good deal of water, it may sometimes be advisable to open the top ventilators slightly, when the temperature in the barn reaches 105° F. to 110° F. This reduces the amount of "sponging" which often occurs when the barn is kept closed until the temperature of 115° (the temperature to be reached before ventilation is generally recommended under normal conditions) is registered within

the barn. The top ventilators are at first opened slightly and the opening gradually increased in order to drive off the excess moisture from inside the barn. The bottom ventilators should be kept closed at this stage of the curing, or only a strictly limited amount of ventilation allowed, as too much ventilation through the bottom vents would defeat the end in view by introducing a fresh stream of moisture-laden air into the barn.

In flue curing there are three distinct stages through which the leaf must pass, namely, yellowing, fixing the colour, and drying the leaf and midrib.

Yellowing the Leaf.—As soon as the barn has been filled, the door and ventilators are closed to prevent the escape of moisture. When the fires are lighted, a thermometer (maximum and minimum reading) and hygrometer are suspended from the bottom tier in the middle of the barn. A suitable thermometer should be graduated in single degrees up to 170° F. The wick on the hygrometer wet bulb should be properly fitted and must be kept moist, otherwise the difference between wet and dry bulb readings will be inaccurate.

The fires at first are small and later are increased in size until the temperature in the barn is raised to 90° F. during the first three to six hours. In the early stages of curing, a low temperature is essential until the leaf yellows; a high temperature at this stage would ruin the tobacco. The temperature is therefore kept at 90° F. until the leaf starts to yellow at the tips and round the edges. Then the temperature is gradually raised to 95° F., and this heat maintained until the yellow colour begins to spread in towards the midrib of the leaf. The temperature is next increased gradually to 100° F., and held there until the yellow colour is more pronounced.

During this time the atmosphere of the barn should be saturated to prevent the leaf from drying out. Sufficient moisture must be kept in the barn to give a reading of 3° or 4° difference between the wet and dry bulbs of the hygrometer. Should the wet bulb register more than 4° below the dry bulb, it signifies that the air inside the barn is becoming too

dry. In this case more moisture must be introduced by pouring water on the floor and lower walls and placing wet bags on the flues. In place of water, low-pressure steam may be introduced until the required degree of humidity has been attained.

When the leaf begins to show more yellow in colour, the temperature is increased to 110° F., and this heat is maintained until the leaf is yellow, with only a slight greenish tinge. The temperature is then gradually raised to 115° F., and held there until the proper yellow colour is developed. Between the temperatures of 100° F. to 115° F. the humidity in the barn is gradually reduced until the wet bulb registers 12° below the dry bulb. Maintaining the requisite degree of humidity in the barn during the yellowing stage is very important.

Fixing the Colour.—This is the most critical stage in curing and it is here that many a barn of good tobacco becomes spoiled. The greatest care in the manipulation of the barn is therefore required. The leaf will turn a reddish brown colour if the atmosphere of the barn is too humid, or if the ventilation is inadequate and the temperature is not increased fast enough. This discolouration of the leaf is known as "sponging," and is caused by moisture collecting on the surface of the leaf. Raising the temperature too rapidly when there is an excess of moisture in the leaf will cause "scalding" and reddish-brown or greenish-black coloured areas to appear on the leaf. Another discolouration is caused through the cells of the leaf being prematurely killed, preventing the necessary chemical changes from taking place. This happens when the ventilation is excessive and the temperature is increased too rapidly. The leaf in this case has a dark greenish-red or blackish colouration. Sponged tobacco is of more value than green or blotched leaf, but the grower should try to eliminate all these classes of leaf.

The main object in fixing the colour is to prevent any further change in colour after the yellowing stage is passed. The barn should be so managed that the moisture is carried off through the ventilators as fast as it is given off by the leaf. The temperature is regulated in such fashion that the colour will be normally fixed in 15 to 18 hours. The top and bottom

ventilators are slightly opened when the leaf is yellowed, and the heat registers 115° F. When the vents are opened, the fire should be increased to maintain the required temperature in the barn. The ventilation is gradually increased while the heat is maintained at 115° F. until the tips of the leaves begin to curl upwards. The next step is to increase the temperature to 120° F., and hold it there until the leaf begins to curl in towards the midrib. The leaf is now drying and the temperature is further increased to 125° F., this temperature being maintained until the web of the leaf is about dry and the difference between the wet and dry bulbs is about 25°.

Drying the Leaf.—To complete the curing it is necessary to dry the leaf thoroughly, and this is accomplished by raising the temperature from 125° to 130° F. in two hours' time, after the web of the leaf appears to be dry. The temperature of 130° F. should be maintained for about four hours, then raised to 135° F. in one hour and held there for about four hours, by which time the web of the leaf should be thoroughly dried out. Ventilation is next reduced and temperature increased hourly by about 5°, until 160° F. is attained. The temperature of 160° F. is maintained until the midribs of the leaves are dry and brittle. Temperatures in excess of 160° F. are not recommended, nor should they be necessary except where the whole plant method of harvesting is employed, in which case the maximum is 180° F.

By using temperatures exceeding 160° F. growers cause a decline in the quality of the tobacco. Excessive heat makes the leaf very brittle and lacking in texture. The colour of the leaf is also impaired and may take on a reddish cast commonly described as "scorching."

It must be clearly understood that the foregoing temperatures are given only as a guide, and while being correct under certain conditions, they are not expected to be suited to the curing of every barn of tobacco during each and every season.

The grower will find the above guide useful in deciding how the curing is progressing and, by modifying the heat, moisture and ventilation, will be able to arrange the rate of curing to suit the type of leaf in the barn and the climatic

conditions prevailing during the curing period. Normally the time required for flue-curing tobacco is from four to six days.

The provision of cement covered floors and the use of hot air ducts for ventilation of the barn will enable the grower to cure the tobacco to better advantage. An excessive quantity of water thrown on to the floor will induce "sponging," particularly in the case of earthen floors. It has often been observed that a thoroughly saturated earthen floor causes difficulty in the reduction of the relative humidity when the temperature has reached 130° F. approximately. At this temperature a great deal of moisture is driven out of the floor; hence the increased humidity, even though the same barn appeared to have the correct degree of humidity at, say, 120° F. or 125° F. Brick floors should be provided with a thin coating of cement for preference, as it is then easier to control the humidity, especially if drain plugs are let in through the wall to run off surplus water when it is no longer required in the barn. The use of warm air in place of the cold air commonly introduced into the barn during ventilation will also reduce the amount of "sponging."

Handling the Cured Leaf.—The characteristics of the cured tobacco are either improved or spoiled in the subsequent handling of the leaf. It is not proposed here to discuss the handling of tobacco after it has been cured, as this phase of tobacco culture has already been fully dealt with in a previous issue of the *Rhodesia Agricultural Journal* and reprinted as Bulletin No. 641.

In conclusion, it may be stated that, to become thoroughly proficient, a tobacco grower needs to gain experience through the actual handling of the crop, for there are certain details in connection with the growing, harvesting, curing and handling of tobacco which cannot be fully grasped through perusal of reading matter alone.

SUMMARY.

(1) The harvesting of tobacco requires care and judgment and has a large influence on the value of the cured product.

(2) Get to know when a leaf is ripe, and harvest leaf which is suitably ripe for the process by which it is to be cured.

(3) Uniformity in harvesting makes for uniformity in curing.

(4) Green tobacco is of low value; take every precaution to produce the absolute minimum of undesirable leaf.

(5) Harvesting of tobacco is facilitated by having adequate barn accommodation.

(6) The tobacco should be carefully handled during the harvesting, otherwise damage may result for which you have to pay.

(7) The curing of tobacco is a scientific process and requires to be studied as such.

(8) Buildings suitable for the purpose are an aid to satisfactory curing.

(9) Do not overcrowd the barn; money is lost when the leaf is damaged through being too tightly packed for curing.

(10) Have your buildings and plant for curing put in working order before the crop is due for harvesting.

(11) Provide for adequate supervision throughout the harvesting and curing of the crop.

(12) Endeavour not to grow more tobacco than can properly be accommodated in your buildings; excessive quantities of tobacco in relation to housing accommodation usually lead to the production of a lower grade leaf.

(13) Every effort should be made to produce quality rather than quantity.

(14) Make provision for future fuel requirements by planting trees to replace the indigenous timber already cleared off the land and conserve fuel by the use of properly constructed furnaces with low fuel consumption.

Animal Husbandry Notes.

SOFT FAT IN BACON PIGS

Slow Growth and Lack of Finish the Most Important Causes

By C. A. MURRAY,
(Senior Animal Husbandry Officer in Charge: Government Experiment Station: P.B. 19 K, Bulawayo).

Just recently there have been a number of complaints from bacon factories in the Colony that farmers are sending in an increasing number of baconers killing out soft and flabby, and therefore unsuitable for bacon production. It is generally recognised that soft, flabby carcases are most undesirable. Bacon from such pigs lacks firmness, is greasy, unattractive, soon goes rancid and is difficult to slice. Even the lard remains soft and lacks body. The reasons for this sudden increase in the number of soft pigs coming on to the market are not difficult to find.

During the past few months pig feeds, especially maize, have become scarce and more expensive. In addition, the present season has proved disappointing for many farmers who depend on their own production for their feed supplies. The result has been that pig producers have cut the grain rations of their pigs to a minimum and this, of course, has reduced the rate of growth of the pigs. To effect a further saving of grain many baconers have also been sent in in a less finished condition than usual.

It will be seen below that both slow growth and lack of finish are two very important causes of soft fat. As a matter of fact investigations carried out by the Division of Animal Husbandry during the past six years have shown that under our conditions these are the two most important causes of soft fat in bacon pigs.

FORMATION OF FAT IN PIG.

Before we go into details, it will be of interest to know something about the way in which fat is formed in the body of the pig.

The pig builds up body fat from the fat, oils and carbohydrates in the diet and indirectly from the proteins. Generally speaking, the fat synthesised from the fats and oils is soft; that from the carbohydrates and protein always firm. Some fats and oils, depending on the amount of unsaturated fatty acids they contain, are much more softening than others. Thus the fats in palm-kernel and cocoanut cakes form comparatively firm fat in the pig, and those of maize and groundnuts comparatively soft fat.

The fat and oil in the feed is always first drawn on for the formation of body fat. Next the carbohydrates are used, and lastly the proteins. The supply of protein in the feed is generally so low that it is hardly ever drawn on for fat formation, and even if it were, the fats so produced would be firm. This is one of the reasons why blood meal and meat meal do not produce soft fat.

When there is a large amount of fat or oil in the diet, the fat laid down in the tissues will, therefore, come mostly from the ingested fat in the feed and will, as a result, be generally soft. If there is only a small amount of fat in the diet, most of the fat formed will come from the carbohydrates, which form firm fat. The effect of the ingested fat will in such a case be small, and the body fat will, as a whole, be firm.

YOUNG PIGS SOFTER.

The effect of the ingested fat is greater in young pigs than in old pigs because in the former the rate of fat formation is much slower than in more mature pigs. As a result of this they get most of the fat required for deposition from the fats and oils in their diet, and consequently they tend to be soft. As the pig grows, the rate of fat deposition increases very considerably, and the animal is then forced to use more and more of the carbohydrates in the diet for fat formation, and so the fat laid on becomes firmer. It is for these reasons that pigs tend to get firmer with age.

A pig which is brought on slowly, or which is unthrifty and is consequently not laying on much fat, can, in a similar way, fill most of its fat requirements from the fat and oils in its diet. Hence the fat laid on by a pig growing slowly is generally softer, other things being equal, than the fat of pigs which are fattened quickly and have to draw mostly on the carbohydrates of the feed for most of their requirements for deposition.

FACTORS CAUSING SOFTNESS.

Now that it has been explained in an elementary way how fat is formed in the pig, it will be easy to understand why one or more of the following factors may cause softness:—

(1) *Unthriftiness.*—Unthrifty pigs are generally soft. Pigs suffering from worms, sunscald or which are wrongly fed and managed are usually unthrifty, grow slowly and hence get soft.

(2) *Slow Maturity.*—Slow maturing pigs are invariably soft. Worms, insufficient feed or poorly balanced rations may prevent the pigs from maturing more rapidly.

(3) *Lack of Finish.*—As pointed out previously, unfinished pigs are always soft, irrespective of the feed they have received. The farmer should, therefore, see that his baconers have the *correct finish* when despatched to the factory.

(4) *Feed.*—(a) Generally feeds high in oil content produce soft fat. Sunflower seed, ground nuts, ground nut cake and soya beans should, under no circumstances, be fed to bacon pigs. Kaffir corn has a slight hardening effect but has a tendency to cause excessive fat. Munga (Nyouti) is superior to both maize or kaffir corn. Experiments at the Rhodes Matopo Estate have shown it to produce a good quality carcase and firm fat. Bran, pollard and wheat screenings are similar to maize in their effect on the fat.

Meat meal and carcase meal produce firm fat. Blood meal and bone meal have no detrimental effect on the firmness of the fat. As a matter of fact, meat meal, blood meal and bone meal when fed with maize to thrifty, early maturing

pigs, produce firm fat. Separated milk is an excellent protein supplement to feed with maize. It produces firm fat. It is generally accepted that skim milk with maize produces a slightly better carcase than meat meal or blood meal and maize. Numerous experiments at the Rhodes Matopo Estate, in the Union and overseas, have, however, shown conclusively that a ration of maize and one or more of the protein supplements, meat meal, carcase meal and blood meal, produces very satisfactory firm bacon carcases where skim-milk is not available.

(b) Poorly balanced rations, such as maize meal or even barley, merely result in softness, and so do rations containing insufficient minerals or vitamins.

(c) Too watery rations, especially before marketing, cause soft flabby carcases. A ration of separated milk only, or of too large quantities of green feed, majordas, pumpkins or sweet potatoes during the last month, will cause softness. Keeping pigs for a few weeks or more on such a ration to prevent them from going overweight, will result in soft watery carcases. A bacon pig, when finished, should be despatched to the factory as soon as possible, otherwise it will either become over-fat or, if starved to keep its weight down, it will be soft.

(5) *Lack of Exercise.*—Pigs are often overcrowded in sties so small that they cannot get any exercise. A medium sized sty in which they can get the necessary exercise will eliminate this defect.

Detailed information on the production of prime quality baconers and porkers, and the erection of suitable piggeries are given in the Departmental bulletins Nos. 1001 and 863 respectively, which may be obtained from the Editor, "Rhodesia Agricultural Journal," P.O. Box 387, Salisbury.

Gully Control: Some Recent Successes.

By DOUGLAS AYLEN, Technical Assistant for Soil Conservation.

ACHIEVEMENTS ARE RARELY CONSPICUOUS.

Though the protection of arable lands has been so widely adopted that systems of storm drains and contour-ridges may be found nearly anywhere in Rhodesia, the control of gullies is so seldom attempted, and even then so far less conspicuous, that a definite search must be made for examples. The limited number of accessable examples is without doubt one reason why adoption of gully control by farmers is not more general, especially when it is still considered by many to be a costly proposition and one of which the results are doubtful. Moreover, the length of time which must elapse before results are obtained not only retards the collection of information but also dissuades farmers from making the attempt. Unfortunately even the somewhat limited information available is far from widespread.

Various measures which had proved successful in a number of cases were described in the articles on "Gully Control" and "Erosion and Malaria" in this Journal during last year. Since these articles were published further information has come to hand, as a few more farmers have obtained satisfactory results during the past year, though naturally some of the initial measures had been instituted some time ago. Besides the number of successful measures undertaken by these farmers experiments were also conducted during last year on a fairly representative number of different types of gullies in the Chindamora Reserve in an area round and about Domboshawa, and only 25 miles from Salisbury.

In this article are described various new features or methods and points which make for success or disaster which have come to light as a result of this recent work. The farm gullies were all either in red soil or black clay vleis, whilst the

Chindamora Reserve gullies of which control was attempted are located in different types of sand veld soil. The information obtained thus covers the major soil types of Rhodesia.

DECIDING FACTORS FOR THE CHOICE OF METHOD.

The main principle of gully control is to create conditions which will make possible the establishment of permanent vegetation. The factors governing the establishment of vegetation are:—

(1) The volume of flow in the gully (or the extent to which it can be reduced).

(2) The stability of the surface of the gully, *i.e.*, extent of erosion of the sides and movement of silt in the bed.

(3) The fertility of the soil.

(4) The extent to which moisture is present throughout all seasons of the year.

(5) Degree of protection which the plantings are given from fire and stock and from exposure to sun and wind.

(6) The materials available for construction of checks, etc.

(7) The kinds of plants, etc., which are available and whether as seeds, plants or cuttings.

(8) Extent of erosion in the catchment area.

(9) The time of year during which the work is undertaken.

It will be readily apparent from this list that the measures employed are of great diversity, but the objectives necessary for economic and satisfactory gully control are always the same and are indicated by the above list of factors which govern the establishment of permanent vegetation in the gully.

The importance of definite planting of gully control on sound lines is all too often overlooked and much of the work has been haphazard. In that case the costs are either much too high or the work fails through weaknesses, but if the work is planned on lines which take into full account the above factors and the following suggestions, the costs will be kept to the minimum, but success will be assured.

CONTROL OF STORM FLOW.

The greater the reduction in the volume and speed of flow of storm water in a gully the easier it is to establish vegetation and the lesser the number and size of structures and checks that are needed. In fact, if there is no flow of water many gullies can be reclaimed without recourse to expensive structures.

For this reason it is advisable to divert storm water from the gully, even if this can only be done temporarily for a season, or preferably two seasons. If an alternative channel is not available it generally pays to make one in the form of a grassed waterway, even though this may mean a year's delay so that grass can make a thick cover in the temporary channel before it is put into use.

If the diversion of the water from the gully is only temporary and the gully will be called on to carry it again in a year or two, the gully must be widened and the sides sloped off so that the speed and volume of flow will not be great enough to cause fresh erosion.

It is the peak flow of the storm water which does most damage. Sometimes the spate lasts only a few minutes, and even in the case of relatively large catchment areas the highest flood seldom lasts more than an hour. Structures and checks, as well as the width of the gully, must be designed to withstand the maximum intensity of flow. It is possible in most cases to reduce the peak flow to a fraction of its former intensity by carefully designed and intensive soil conservation works in the catchment area. Contour-ridges and drains not only store up a huge amount of water, but they release it more slowly, and if correctly designed increase the distance the storm water must travel. If this water is then discharged on more gently sloping and thickly grassed places such as vleis it again travels more slowly. Here more water may be stored and the speed again reduced by diversion and spreader banks. In cases where this has been done the previously high peak flow of short duration has been spread to a steady flow which lasted for hours, and even up to half a day.

The value of this storm water control as an assistance to gully control cannot be overestimated, and either complete diversion or control of storm water is an absolute essential for both satisfactory results and economy.

SLOPING OFF GULLIES.

Recent experience has demonstrated that the trimming of a gully by sloping off the sides and raising and widening the bed must be carried out over a greater width than is the usual practice if the repaired gully is to be called on at a later date to receive any considerable flow of water without the danger of erosion recommencing. The new bed must be made sufficiently wide for the flow to be kept shallow, and also the grade must be evened out, and reduced when relatively steep by the use of additional checks or structures.

At the same time, any kinks or spurs in the banks must be removed, whilst sharp bends in the gully should be reduced to smooth curves.

Depths and widths of gullies vary to such an extent that it is impossible to give any exact rule for the determination of the new width of the bed, but it is suggested that where the slope is moderate the new bed might be given a width equal to double the cross sectional area in feet of the highest flood in the gully. This figure could be reduced for lesser slopes, but even on the gentlest slopes the bed width should not be less than the previous cross sectional area in feet.

Referring to Fig. No. 5, $(A+B)\times C$ twice the cross sectional area.

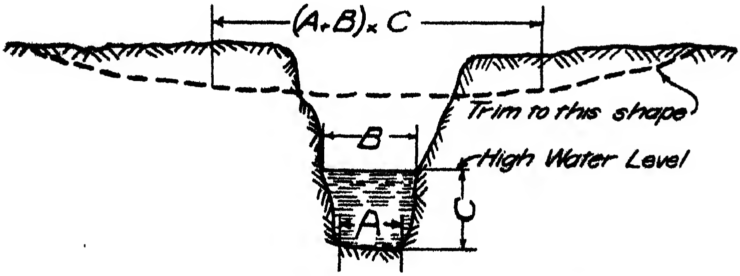


Fig. 5.—Degree of filling and widening necessary.

Alternative methods which will assist one to decide on the extent of widening which must be undertaken are: (1)

Fig 1.—A diversion drain round the head of a big gully

Fig. 2.—A dry stone masonry weir. When constructed a year ago the gully was bare and eroding

Fig 3 —Earth dams and spreader banks across a gullied vlei

Fig 4 -A gully filled with silt. After the construction of bolsters grass became established and silt has since raised the bed.

Continue work until the gully has been reduced to one quarter its original depth; (2) make the overall width of the new channel four times the original bed width for wide gullies, and up to eight times this figure for the deep narrow type. These alternative methods should only be used as a check on the first method.

If erosion is not to recommence in the repaired gully when it is again called on to take the flow the depth of storm water should not exceed the following figures:—Gentle slopes, 2 feet; moderate slopes, 1 foot; average slopes, 6 inches; steep slopes, 4 inches.

It is possible that in certain cases the gully will have been made so shallow that it overflows its banks. This is not a disadvantage in a vlei, where the structures if any have been made wide enough. Where a repaired gully runs through arable lands the overflow could be restricted in width by banks alongside the gully, but these banks must be made far enough back from the edges so that they do not cause the storm water level to rise above the depths given in the preceding paragraph.

The side slopes of the gully should be made so easy that no crumbling or slithering can occur, otherwise plants will be unable to grow. The maximum slope for these conditions is 1 in 2, but if the gully is in a pasture and only temporarily fenced off from cattle, the side slope should be made far easier, say 1 in 4 at least, if not 1 in 5.

Figures Nos. 6 and 7 show gullies which have been sloped off. It was found that a native could slope off 10 yards of 4 feet deep gully, or 3 yards of 12 feet deep gully per day to a wide shallow slope. The total width is from 5 to 7 times the original depth for very narrow gullies and 4 times this figure for larger or wider ones.

The Chindamora gullies varied in size from a large gully over 12 to 15 feet deep and with a bed width which varied from 15 to 50 feet, through all intermediate sizes to small ones two feet deep and one foot wide, and in all numbered 20 odd. Lengths, too, varied from 50 to several hundred yards. In every case it would appear that extensive sloping off and widening was well justified. In Chindamora it had

already been found that controlled grazing combined with the subsequent reduction in storm water had enabled wide shallow gullies to heal naturally, so this type when encountered in the area was left.

FAVOURABLE CONDITIONS ARE NECESSARY FOR THE ESTABLISHMENT OF VEGETATION.

Main reliance for gully control should be placed on re-vegetation. Even when conditions are such that masonry structures are needed the rôle which vegetation should play as a supporting measure should not be overlooked.

Failures of attempts to establish vegetation in gullies are frequent because the existing soil conditions are not modified. Plants cannot survive on either hard packed soil or infertile sub-soil. A hard packed surface should be broken with a pick and sterile sub-soil should be covered with a layer of top-soil, but this loosened soil will be washed away unless the flow of storm water is reduced or controlled. Control of the speed of flow is best affected by numerous small checks.

No plant can grow on dry steep banks. Sloping off permits the penetration of rain water and reduces losses. The types of plants chosen should be species which can exist under the moisture conditions prevailing at the site. Only swamp-loving plants can exist in wet conditions and only plants which do not need much water can survive a winter if planted on banks lacking moisture.

Whatever is done to improve the soil and moisture conditions in a gully general conditions will still be severe for young plants and seedlings. A thin mulch of straw, and if possible with a sprinkling of tree-branches on top of it, has numerous advantages. It controls sheet erosion, ensures penetration of more rain, reduces evaporation, shades seedlings from sun and wind, and later provides some humus. The mulch also keeps the soil lighter and looser. Spoilt hay when available also serves as a source of seed. If the branches are obtained from thorn trees they act as a very effective deterrent to cattle. Cattle must be kept out of the gullies. Even one beast wandering up and down a gully can do an immense amount of damage, very much more than could be thought possible, unless one has closely compared results.

The same remarks apply to fire. In fact, the reclamation of many wide and shallow gullies has taken place without further effort after storm water, grazing and fire have been controlled.

CHOICE OF TYPE OF STRUCTURE OR CHECK.

The choice is governed by the material available, the depth of the gully and the volume of water which passes down it during intense storms.

Concrete structures or masonry weirs have no substitute in large deep gullies where the volume of storm water is appreciable, especially when the bed of the gully is composed of hard packed or sterile material. These structures must be made with far greater care than is generally given them, particularly the keying of the structure to the bed and banks and the foundation of the apron must be perfect. The structures of this type should be made in the form of a weir with wings carried well into the bank and which rise some way above highest flood level. The weir should be made low enough so that even during the worst floods the level of the water does not reach the top of the banks of the gully. (See figures No. 10 and 11).

The sill should be made as wide as the future bed of the gully will be when the sides are eventually sloped off. It is common practice to postpone the sloping off under such circumstances, but all too frequently the structure is made much too narrow, sometimes as narrow as the existing width of the gully. This error inevitably leads to trouble. The apron should have considerable strength and be 2½ times as long as the drop, be as wide as the future final width of the bed, and also should be carried some way up the sides.

Small Check Dams.—Low barricades of stakes and brushwood or stone and wire netting bolsters are quite satisfactory if well made, but are very liable to failure through water eroding a hole underneath them, unless they are well keyed into the bed, and they should also be taken some way up the sides.

Stone and wire bolsters if made low and heavy and let some way into the ground are not washed away, but many

farmers through trying to achieve too much (*i.e.*, making the bolster too high) neglect stability with the result that the bolster is either undermined or swept away.

Stake and brushwood dams also are usually made too high. It has been found that these temporary structures are very liable to be holed if they are more than a few inches high. Usually, however, farmers make them so high that the first flood knocks over several stakes, or even sweeps away everything.

HEAD EROSION.

Where the flow is seasonal the construction of an inclined stone pitched revetment plugged with grass roots appears to be the most economical and effective method of treatment. See fig. No. 14. All of the incline should be cut out of solid

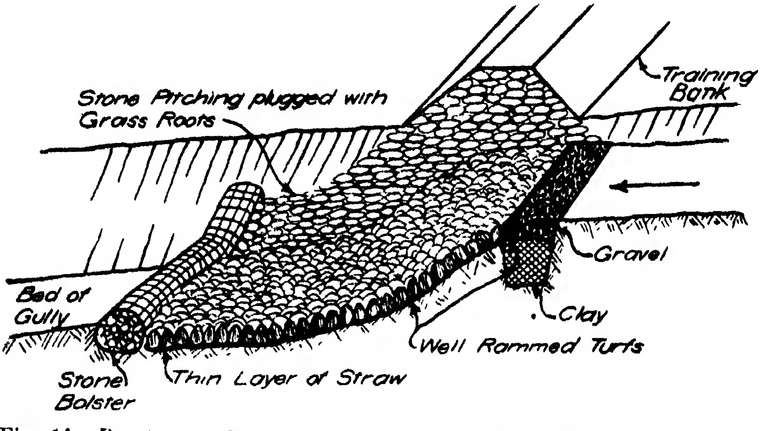


Fig. 14.—Revetment of stone pitching plugged with grass roots for gully head.

earth and made with a hollow down the centre, with the slope in the form of a gentle "S" curve with the lower end of the "S" extended to form an apron ending in a bolster and the upper end carried some way into the higher bed level. A very thin layer of old wet straw or hay is first spread over the surface and then commencing against the bolster the stones are laid in rows as headers. As the stones are laid all spaces are filled with well rammed sods of swamp couch and Paspalum dilatatum, with perhaps roots of common couch intermingled as well.

The last few rows of stone continue beyond the incline and into level ground with the tops just level with the surface. Turfs are then packed against the side of the last row and fine gravel rammed against it, and used to fill the narrow trench which is left. If the soil is pervious a cut-off trench filled with well rammed clay should have previously been made across the gully head just where the stone pitching ends.

THE FUNCTION OF CHECKS AND STRUCTURES.

The purpose of low structures is to create conditions which will facilitate the establishment of permanent vegetation. The strength and number required depends on the flow of water and the slope. When once the movement of the soil in the bed has been stopped and provided there is sufficient reasonably fertile soil or silt present, plants will commence to establish themselves naturally from wind and water borne seeds, but this process is too slow and at times impractical, *e.g.*, a gully sloped off at the end of the rains may have enough moisture to support planted grass but would not become naturally seeded until the middle of next summer. If grass were planted so that it made good cover before the next rainy season fewer structures would be needed, whereas if left to nature many structures might be needed to hold the gully until it became covered with dense vegetation.

SPACING OF STRUCTURES TO ENSURE SATISFACTORY RE-VEGETATION.

As stated earlier, if all storm water can be excluded from a sloped off and graded gully with a gentle or moderate slope structures may not be needed, since grass strips plus seeded annuals will be able to hold the soil a few weeks after planting. However, if it is not possible to exclude all storm water, but the gully has been widened or the flow reduced so that during storms the depth of water does not exceed about six inches, the checks can be spaced so that the gradient from the foot of one to the crest of the next lowest is 1 in 50. A deeper flow will require closer spacing.

It is only possible to plant dry gullies towards the end of the summer, unless the work is done by stages during the summer when grass or reeds should be planted just above

each check, bolster or weir as it is completed; it is at such places that soil movement will be at a minimum and therefore where conditions for growth will be the least unfavourable.

As soon as the plants have made sufficient growth to dam up some silt further strips may be planted a yard or two above the last line. This process can be repeated at intervals through the summer until the space between checks has been completed.

PLANTING GULLIES.

It is not necessary to plant the whole of the gully closely, because if the plantings are made as lines across the gullies they will soon act as barriers. The spacing between the lines will depend on the type of plant used. Giant couch for example will make runners several yards long, and Paspalum dilatatum makes a very dense and resistant turf. If these or other suitable grasses are planted closely in the line, the lines may be made two or more yards apart according to the nature of the conditions prevailing.

When conditions permit the seeding of a fast growing vigorous annual between the rows it is possible to increase the spacing between lines. These plants or their stubble afford protection until the permanent vegetation has become well established.

In some cases this method of utilising one measure to support another may be extended to employ almost all measures, *e.g.*, a limited number of several types of structures and checks as well as the planting of annuals and perennials. This is often the most economical and effective method for the treatment of a large gully, in which perhaps masonry weirs would be required at one or two critical places, whereas other places with a steep but not vertical fall could perhaps be held with bolsters. Between these structures one could make low stake and brushwood checks, and in turn between these checks would come closely planted strips of grass, whilst vigorous annuals would be planted between the lines of grass.

These lines of grass must, like the checks, be taken up the side-slopes to a point above highest flood level. In a deep gully the side-slopes must also be planted with horizontal

Fig 6.—A deep narrow gully being filled in

Fig. 7.—The same gully a short time later

Fig 8.—A gully in a vlei just after the construction of diversion drains and sloping off and planting

Fig 9.—The same gully a year later.

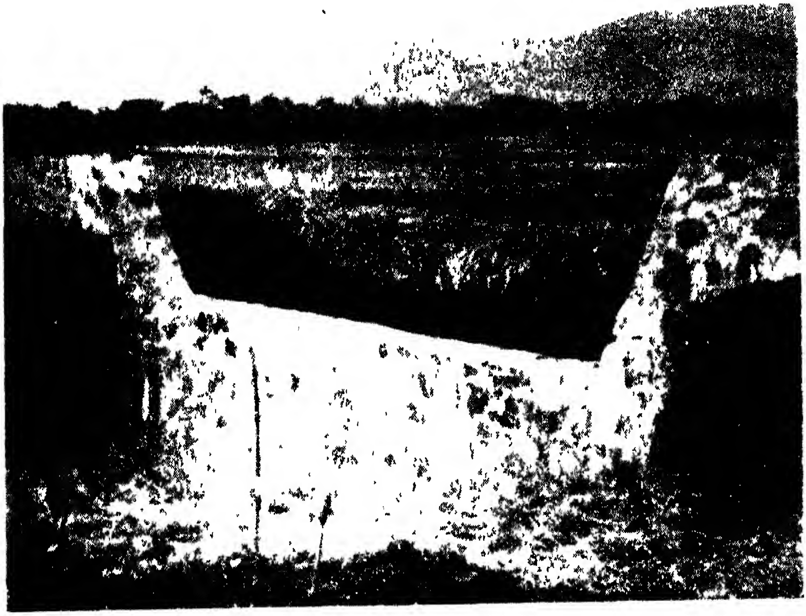


Fig 10—A stone and cement weir across a large gully Training bank and sides to the apron not yet completed

Fig 11—The same weir a few years later.

Fig 12.—A large gully shortly after the construction of stake checks and the planting of grass (Taken in July.)

Fig. 13.—The same gully six months later.

lines of grass. However, if the gully has been filled in to such an extent that it has a very wide and shallow dished shape, the lines of grass may be run round as curves on the contour, with perhaps only alternate lines taken out to the edge of the banks, whilst the others are ended at highest flood level.

A FEW SUITABLE GRASSES.

Common Couch grass is the most suitable plant for situations which do not become water-logged. The giant variety will grow well if the soil is fairly pervious and able to retain moisture, but if the soil is tight or has been packed a short variety should be used.

Swamp couch is generally the most successful grass in wet situations, but on occasion does not do well. *Kikuyu* does well on moist, but not wet fairly rich and loamy soil.

Eulalia geniculata makes good growth on soil which is water-logged during summer.

Paspalum dilatatum and *Paspalum virgatum* do well in black clay (vlei) soil. The former requires moisture throughout the year, but cannot withstand prolonged water-logging, whilst the latter will grow in puddles an inch or so deep.

Para grass has rapidly covered the banks of several gullies in vleis. Later other grasses oust it, but it provided the all-important first cover.

M'lange grass makes a rapid but thin cover on any fairly fertile soil. *Nirvaska star* and other *giant star grasses* make very good and rapid cover under favourable conditions.

Digitaria abyssinica made wonderful growth after a slow start on the banks of gullies. In other places it has been found that once established it soon spread to adjacent bare spots but was later unable to withstand competition from other grasses. This is not a disadvantage in gully control work. This grass and also *Digitaria swazilandensis* show promise and could be used where reclaimed gullies or grassed waterways run through arable land, conditions where common couch would be unpopular owing to its habit of spreading and the difficulty of controlling it in banks. They both require somewhat better conditions than the poorest under would couch will make good growth.

The *common wild reed* is slow to start, but even in sand or gravel beds eventually makes a growth quite resistant to damage by stock. The underground (or under water) "runners" enable it to spread quite rapidly when established. It is most suitable for wet conditions and where the storm water is deeper than usual.

FAST GROWING ANNUALS FOR IMMEDIATE PROTECTION.

Erosion will continue until the permanent plantings have made good growth. This erosion also retards growth, but a quick growing annual will not only stop the erosion but act as a nurse crop. During the winter the stubble will also give protection whilst the straw will form a mulch and eventually supply a little humus to the soil.

These annual plants must not be planted so close to the perennials that they compete with them. They should either be broadcast thinly or sown in strips between the lines of permanent grass, and covered with soil, using a garden rake.

Some plants which have proved suitable are amber cane, sunnhemp, munga (Inyouti), native cowpeas and rye. A few oat seeds which were accidentally present in seed broadcast at Chindamora also did well.

PLANT A MIXTURE.

For reasons not yet understood one grass or another sometimes fails to grow in very localised areas, even when conditions appear favourable, consequently to be on the safe side a mixture of those grasses which appear most likely to thrive should be used. In one Chindamora gully the survivals of the mixture made clearly visible patches of single varieties, with a few complete failures in small patches, whilst in between could be found patches were all had survived.

In all gullies where control has been successful it has been noted that once the planted grasses have been sufficiently established to check movement of the soil, the spaces between rapidly became filled with self-established grasses, sedges, bulrushes and plants.

PLANTING COUCH GRASS.

Natives are so apt to allow the roots to become exposed to the sun and wind for long periods when gathering and planting couch grass that the best method would appear to be to finish all sloping off, etc., first, and then dig small trenches for the grass roots, quickly collecting all roots required for an hour or so's work, in damp sacks. Whilst some natives are sprinkling roots in the trenches others should cover the roots, using hoes to rake in the soil. The roots may be covered with several inches of soil with advantage, but other grasses must be more carefully planted in the arthodox manner. This system permits close supervision which is a vital factor in successful planting. In spite of careful instruction and fairly reliable supervision much of the planting in Chindamora failed because of poor work.

TREES AND SHRUBS, ETC.

Trees are the most suitable material for the reclamation of a badly gullied area. So far only white poplars have been used to any extent in Rhodesia and they have been particularly successful in controlling erosion in badly gullied vleis, as in such conditions they spread rapidly when once established by making suckers. This is an advantage as regards erosion control but also means that they will encroach on any moist soil. Hardy pines, cypress, eucalypts are well suited for the reclamation of severely eroded but not deeply gullied areas where a thicker layer of pervious sub-soil overlies the impervious strata. Wattle has proved most successful on the Eastern Border, whilst where conditions of low rainfall exist Euphorbia tirucalli, also known as rubber plant and pencil Euphorbia, has been most effective.

Mauritius thorn has also controlled erosion of gullies when planted on the banks, but in red sail and where rainfall was fair.

Several gullies have been reclaimed by planting Agave (sisal) in close double rows just above a series of low stake fences made at intervals along the gully.

During last season cuttings and small truncheons of some eight native trees were stuck in in rows across a number of

the gullies sloped off in Chindamora Reserve. This work was done in late June (two to three months too early, as circumstances were such that it could not be later). A number of varieties have made good growth and appear to be succeeding.

The most successful appear to be Commiphora (Minyela—native name; Kanidot—Dutch name), wild fig (small leafed variety), and *Lanea discolor* (Mushamwa).

There are at least fifteen or twenty native trees and shrubs which strike readily from cuttings and many more which will grow from seed, as well as a number of introduced species which should prove useful. Of the latter besides poplar, as far as it is known, only mulberry, willow and Maritius thorn have been used to any extent.

Mulberry and willow strike easily, except in water-logged soil, and seeds or seedlings of Maritius thorn do well except in vleis.

Cuttings, slips and truncheons are best taken just before the new buds commence to swell. They are best planted by making a hole of ample size and depth, and into which some sand should be placed. The cutting is then inserted so that only a short length obtrudes and sand is then packed and tamped in the hole until it is filled.

CARE OF PLANTINGS.

Rank wild plants with poor root system and heavy top growth such as "gooseberry" stinkblaar, Mexican marigold, etc., will shade out and even kill by suffocation the desirable "turf forming" plants and grasses, and young trees, and conquently should be slashed down once or twice during the first season. Erigeron (flannel weed) is an exception, as though tall it gives no more than a desirable amount of shade whilst the mass of leaves at the base and shallow roots hold the soil, and it is an effective barrier to grass fires. It disappears as soon as grass or trees have made sufficient growth to hold the soil. In fact, it is best left to act as a nurse crop to provide shelter for the plantings, whether trees or grass.

Fig 15.—The central one of three gullies caused by head erosion from the deep culvert

Fig. 16.—The gullies reclaimed by an arched weir constructed above the culvert.

Fig 17.—A large gully in a vlei made by one very intense storm

Fig. 18.—The same gully two years later Tree slips were struck in the bed

THE DANGER OF "SKIMPING."

Economical control of gullies depends on sound planning and execution. The protective works must be sufficient to permit the planted material to spread and to permit the self-establishment of wild plants. Due consideration of the factors which govern the satisfactory establishment of vegetation will make it possible to plan so that the size and number of expensive structures may be kept to a minimum. but anything less than this minimum or any skimping or careless work is bound to give rise to failure, as when one check or structure fails the others are overloaded and as a result most of the work in the entire length of the gully suffers serious damage at least, or may even be destroyed.

CONTROL EROSION IN THE CATCHMENT AREA.

Quite a number of gullies have been treated and become well-grassed, but owing to the continuance of erosion higher up the beds later have been raised by silt deposits until the water overflowed and found a new gully alongside the repaired one. Control of storm water and erosion would have averted this occurrence. In other cases previously effective channels have become inadequate because of increased run-off due to depletion of cover in the catchment area. The permanency of gully control is therefore greatly dependant on the measures taken in the catchment area.

THE THIRD DIGIT.

Mr. Mansfield, Director of the University Farm at Cambridge, is quoted by *Country Life* in connection with the proper care of land as follows: "It must be kept drained, the lime content must be adequate, it must be kept clean, the humus content must be maintained and the supply of available plant food must be maintained."

Count these over on your hand and reflect that your middle finger is the biggest—and that

Cleanliness Aids Insect Control.

Veterinary Notes.

A NOTE ON THE POISONING OF STOCK BY NITRATE OF SODA

By P. D. HUSTON, M.R.C.V.S.

The increase in the use of Nitrate of Soda as a fertiliser for tobacco growing has given rise to a marked increase in deaths of cattle from poisoning by this salt. In fact, deaths from it were practically unknown until a few years ago, but to-day they are quite a common occurrence.

As with Arsenite of Soda, nearly all cases investigated show that gross carelessness in handling this poison has been responsible for the cattle having access to it. Cases have occurred where it has been fed to cattle in mistake for common salt, yet on investigation the sack from which the supposed common salt was taken was labelled "Nitrate of Soda. Poisonous to Stock." In other cases it was found that the Nitrate of Soda was left at the tobacco seed beds during the week-end or overnight, possibly protected against the weather by sacks or a sheet of iron. Cattle had been allowed to stray to the beds, had scented the salt and managed to obtain access to it.

Death from this salt appears to be very rapid under field conditions. In one case investigated the nitrate was used in mistake for common salt. It was placed in the troughs about 4 p.m., and four head were found dead in the paddock early the next morning, these animals having probably died about 12 p.m. In the remainder of the herd no animals appeared to be sick. In another case where oxen had access to the salt at the seed beds, death again took place in about six hours.

Analysis of stomach contents for the presence of Nitrates has been very disappointing because in nearly all cases this has proved negative, even where the post mortem examination and the history of the case left no doubt whatever as to the cause of death.

POST MORTEM APPEARANCES

On skinning the carcase it will be seen that the fat is darker and more yellow than the normal beast; the blood is of a brownish red colour and does not clot easily; the muscles when cut into are much the same colour owing to congestion with blood.

The colour of the blood will be one of the most obvious symptoms to the layman since in nearly all other conditions it is blackish red and clots quickly. On opening the carcase an acute inflammation of the rumen (first or large stomach) will be found which is most noticeable along the sides of the oesophageal groove on top of this organ. If the black lining is scraped off, it will be found that the wall underneath varies in colour from a light pink to a dark red indicating acute inflammation and this inflammation also appears in patches over the rest of this stomach. The second and third stomachs occasionally show small inflamed areas. The fourth or true stomach is only slightly inflamed and pinkish in colour thereby differentiating this type of poisoning from arsenical poisoning in which the true stomach is acutely inflamed, and varies in colour from a dark pink to a very dark red or even black.

The large and small bowel may be very slightly inflamed or even normal in colour and appearance.

The lungs, liver and kidneys are very congested and when cut into, brownish-red blood exudes. The lungs instead of being of the usual light pink colour are deep red owing to congestion with the blood. There is a slight inflammation of the bladder.

TREATMENT

There is no direct antidote for Nitrate of Soda poisoning and because death ensues quickly, there is little opportunity for treatment. Consequently, prevention becomes all the more important, but if poisoning from this source is suspected a drench consisting of tincture of Opium 2 ounces, Aromatic Spirits of Ammonia 2 ounces, Linseed oil 10 ounces, lime water 10 ounces, should be given.

Farmers should make a point of seeing that all Nitrate of Soda is kept under conditions where it is inaccessible to animals, and stocks should be kept under lock and key so as to render malicious administration impossible.

Laboratory Diagnosis of Disease

By J. M. WILLIAMSON, B.SC., M.R.C.V.S.,
Veterinary Research Department.

PART II.—SUBMISSION OF SPECIMENS.

COLLECTION OF BLOOD SAMPLES FOR CONTAGIOUS ABORTION TEST.

Contagious abortion can only be diagnosed satisfactorily on suitable blood samples. "Smears" such as are submitted for the diagnosis of other diseases are useless for the detection of contagious abortion.

The test for this disease is made with the serum that is expressed from clotted blood, and such serum must conform with certain requirements in respect of quantity and quality.

Special pipettes (lengths of narrow glass tubing corked at each end) and preservative are supplied for the collection of blood samples for the diagnosis of contagious abortion. The pipettes are issued in wooden containers of one or two dozen each.

HOW TO COLLECT A SAMPLE.

In cases where it is possible to deliver the blood samples to the Veterinary Laboratory within 24 hours of collection the use of preservative may be omitted. In all other cases first introduce a small quantity of the preservative into the pipette, only sufficient to extend for approximately ¼in. in the length of the tube. Too much preservative causes too great a dilution of the serum subsequently obtained, and too little fails to preserve it adequately. A simple way of introducing preservative is to remove both corks from the pipette, then dip it into the preservative so that about ¼in. is filled, close the protruding upper end with the finger, remove it from the preservative and recork the lower end.

To obtain blood from the animal to be tested, clip the hair from the margin of the ear and wipe clean with a dry

cloth, then with scissors or a sharp knife cut into this part, making the incision about ¼in. in depth. Blood will normally commence to drip or flow freely within a few seconds. If it does not, then a few sharp slaps over the cut portion will start the flow. Alternatively, one of the superficial ear veins may be punctured with a needle or knife point.

Bleeding is best carried out during the heat of the day; difficulty is experienced in obtaining blood from ears that are cold. On no account should blood be collected during rain or immediately after dipping, as moisture of this type ruins the sample; strict cleanliness in collection of samples must be observed.

Hold the pipette so that its open (still uncorked) end just touches the cut edge from which blood is exuding and allow the blood to flow in until the pipette is *completely filled.* It is advisable to hold the pipette at an angle during this procedure, i.e., not directly vertically, and to allow the blood to flow in along one side, otherwise an air lock might result. Having filled the pipette, recork it and shake it gently to mix the blood and preservative together.

If no preservative is being used it will be found that the pipette is more readily filled by removing both corks before starting. The pipette is then held almost horizontally so that the dripping blood gradually flows along its lumen. When almost full a cork is inserted into the lower end, this pushes the blood slightly up the lumen thus completely filling the tube.

Filled pipettes should be wiped clean on the outside and replaced in the box. It is essential that each pipette be numbered so that it can be referred to a particular animal. Numbering can be effected either by putting a small gummed label round the tube, or, less satisfactorily, by writing the number on the wooden box in a position corresponding to that of the tube.

Failure to identify the sample in respect of a particular animal renders the test useless from the point of view of being able to cull or segregate reactors.

When dealing with named or numbered animals subsequent identification by the owner presents no difficulties, but

in the case of ranch cows, for example, it is advisable to number them at the time of taking the sample. This can be done with paint, or by clipping the hair, or, better still, if number brands are available, by making a light (hair) brand.

Blood samples are also of assistance in the diagnosis of paratyphoid infection in calves. The procedure for their collection is exactly as detailed above, it is essential, however, that the sender definitely state that the samples are to be tested for paratyphoid infection otherwise they may be tested for contagious abortion.

It should be noted that the blood of calves in the acute stage of paratyphoid infection does not contain agglutinins on which serological diagnosis has to be based. These agglutinins take some time to develop and consequently they can be detected only after the disease has become semi-chronic or when recovery has resulted. In attempting to have a diagnosis of the cause of calf losses established, it is necessary to send in blood samples from the advanced or recovered cases.

COLLECTION OF BLOOD SAMPLES FROM POULTRY.

The diagnosis of bacillary white diarrhoea, fowl typhoid, and other Salmonella infections in poultry is generally made from an examination of dead birds. Blood samples on the other hand are of great value in the detection of carriers of these diseases. The detection of carriers is of importance not only because they disseminate infection in their droppings, thus infecting the ground and all birds in contact, but also because these diseases can be transmitted through the egg to the following generation.

The pipettes in which the blood is collected are the same as those used when submitting blood samples from cattle for contagious abortion test. The amount and method of using preservative have been described under that heading. Here again, if it is possible to deliver the blood samples to the Laboratory within 24 hours of collection, the use of preservative may be omitted.

Technique.—Instruct the assistant to hold the bird breast uppermost with the left wing pressed firmly against his side

at a height convenient to the operator, the tail and legs controlled by the left hand and the head and neck tucked beneath the right arm; the assistant then extends the right wing by firmly holding it at the base—the pressure thus applied also distending the wing veins; pluck a few feathers from the under surface of the wing in the region of the first joint from the body, thus exposing the prominent veins. With a lancet or needle puncture a distended vein at the point where it crosses the joint, the blood will then flow out and is collected in a pipette as described for contagious abortion.

SUBMISSION OF FAECES SAMPLES.

The most satisfactory means of determining the state of worm infestation in an animal is by a careful post-mortem examination. But as this is not always possible a reasonable indication of the position may be obtained by the examination of a suitable sample of faeces taken from the live animal. In the case of large animals the amount to be collected should be about ½lb., in smaller animals less will suffice, but as much as possible up to this amount should be sent. Generally speaking a more accurate result is obtained if the sample is taken from more than one dropping, for this purpose the animal should be isolated for a day, then the total amount of faeces mixed and a sample taken. The specimen should be delivered to the Laboratory as soon as possible since some eggs hatch within 24 hours, and if this takes place to any appreciable degree an inaccurate estimate will result. The addition of a few c.cs. of formalin solution serves to prevent the eggs from hatching and if, for any reason, delay in submission of a sample, cannot be obviated this precaution should be taken.

SUBMISION OF SKIN SCRAPINGS.

A definite diagnosis of mange should be given only after the demonstration of the casual parasites. For this purpose a suitable skin scraping is necessary. All that is required in the way of apparatus is a scalpel or knife and a small tin or bottle with a well-fitting lid or cork. It is important to have a fairly sharp instrument for scraping as this greatly facilitates the operation and is less painful to the animal.

The suspected area—especially around its edges—should be scraped till small pin points of blood begin to appear. It is useless to submit only the superficial scurf and bits of dirt and hairs covering the lesion, since the mange parasites are actually in the skin, not on its surface. The material removed during scraping is more readily collected if the surface is slightly moistened before starting. Where possible the moistening of the skin is done with 5 per cent. caustic potash solution which also has the effect of softening the superficial skin layers, otherwise warm water may be used. From a large animal or pig the amount of "scraped" material collected should fill a teaspoon, from smaller animals less will suffice. Having put the "scraping" in a small tin or bottle apply the lid or cork tightly to prevent any mites escaping. It is advisable to take scrapings from more than one area, thereby enabling a greater amount to be collected, and doing away with the possibility of submitting a sample from a lesion in which the parasites are no longer present.

GENERAL SPECIMENS.

It frequently happens that stock-owners are themselves obliged to make a post-mortem examination on a dead animal. If during their examination they discover some abnormality with which they are not familiar, the affected organ or part of it should be sent to the Laboratory preserved in 10 per cent. formalin. Any worms, flukes, etc., for identifiiation, must be washed free from contaminating dirt and mucous, then preserved in methylated spirits, brandy, etc.

If our great leader had been an entomologist he might have said with regard to agricultural hygiene:—

"Never have so many insects been controlled with so little trouble to such great effect (by so few?)"

Cleanliness Aids Insect Control.

Ticks Infesting Domestic Animals in Southern Rhodesia.

By Rupert W. Jack, Chief Entomologist.

Revised. February, 1942.

The following article aims at placing in the hands of stockmen, and others connected with the cattle industry, a popular guide to the ticks which infest stock and domestic animals generally in this Colony, together with an account of their habits, life histories, relation to animal disease and measures employed for their control.

Ticks are very clearly divided into two families. There are a number of characters by means of which the members of either family may be distinguished, but for our purposes it is sufficient to note that in the family (*Ixodidæ*) to which the common cattle ticks belong there is a hard shield on the back of the tick, which in the male covers practically the whole of the back and in the female a smaller area close behind the head (see illustrations of male and female ticks on Plate I.). In the other family (*Argasidæ*), of which the Spinose Ear Tick, the Tampan and the Fowl Tick are representatives (see Plate II.), this hard shield is altogether lacking. Also in the *Argasidæ*, except in the larval stages, the mouth-parts are invisible when the tick is viewed from above, whilst these parts project in front of the body in the *Ixodidæ*.

Not only do the members of these two families differ in appearance, but also in life history and habits. Ticks of the family *Ixodidæ* all have a similar life history, which is illustrated in the diagram on Plate IV. The minute tick, as it first hatches from the egg, possesses only six legs, in contrast to the eight borne by the later stages, and is termed as *larva*. This larva crawls up to the top of the herbage or other convenient point of vantage and is brushed off by its hosts (*i.e.*, the animal on which it feeds). It then inserts its mouth-parts

into the skin and commences to fill itself with blood. Its skin is capable of distention, and as it feeds the larva swells up, finally becoming completely engorged. It now stops feeding and may either drop off on to the ground or remain attached to its host by its mouth-parts. In either case, the second stage of the tick gradually forms within the loose skin of the larva, the skin is finally ruptured or *moulted* and out crawls the tick in its second stage. It is now seen to possess eight legs instead of six, and is termed a *nymph.* If the moult has taken place on the host the tick has only to wait until it is sufficiently hardened before "biting in" and commencing to feed again. If the moult has taken place on ground the nymph repeats the performance of the larva, crawling up to a place of vantage and waiting until it is brushed off by one of its hosts, when it once more attaches itself and commences to feed. Like the larva, it feeds to engorgement and becomes greatly swollen. Again the tick may detach itself or remain on the host and the moulting process is repeated. The ticks which emerge from the nymphal skin are now in the adult stage and for the first time the sexes are distinguishable, as already pointed out, by the back of the male being covered by the horny shield and the much smaller shield borne by the female. Shields similar in proportion to those of the females are as a matter of fact borne by both the larva and nymph, and serve to support the "head" whilst leaving the bulk of the tick's skin soft and capable of great distension. Both the male and female attach themselves to their hosts and suck blood, but the male feeds comparatively little and does not gain conspicuously in size, whereas the female becomes greatly swollen and fully engorged. The female then detaches herself and falls to the ground, crawls into a convenient shelter, and soon commences to lay eggs. Several thousand eggs are produced, and in the process the female tick gradually shrivels and dies. After an interval the eggs hatch, producing larval ticks, and the life cycle recommences.

The common cattle ticks have thus three distinct stages after leaving the egg, namely, the *larva*, the *nymph*, and the *adult.* From what has been said concerning the fact that some species drop off for each moult, whilst others remain on the host for one moult or both, it is obvious that some species

may feed upon three different animals during the course of their development, others on two and some only on one. It is usual to speak of them as having a one host, two host, or three host cycle. This difference in habit has, as will be seen, an important bearing on disease-transmission and on the results secured from dipping.

Having thus touched lightly on the fundamental points in the life history of the common cattle ticks, we are now in a position to deal separately with the various species prevalent in this territory and their respective peculiarities in regard to disease-transmission. The species differ from one another not only in size, form and coloration, but also in various minor characteristics, very important amongst which is the length of mouth-parts, these organs being very much longer in proportion to the body in some species than in others. This variation in the mouth-parts is shown on Plate I.

The Bont-leg Tick (*Hyalomma aegyptium impressum*, C. L. Koch)*.—This tick, of which the male is illustrated at fig. 1 on Plate I., is amongst the best known of all in the territory. Unfortunately, there is a tendency to use the name "Bont Tick" in reference to it, but this name should be reserved for the species to be considered next. The Dutch word "Bont," meaning "parti-coloured" or "piebald," obviously applies only to the legs of this species, the body of the tick being dark brown. The species is readily distinguished by its banded legs and dull dark brown body, the surface of the shield in the male being closely pitted all over. The unfed female is very similar in appearance to the male—in fact in this species the sexes are rather difficult to distinguish without the aid of a hand lens, as the female shield, with its rough surface, merges inconspicuously into the remainder of the tick's back, with which it is uniform in colour. The males and unfed females measure up to nine thirty-seconds of an inch in length, including the mouth-parts. The fully engorged female may measure some three-quarters of an inch in length by five-eighths of an inch in breadth.

*Also the original *Hyalomma aegyptium aegyptium*, L., which is also common in the Colony.

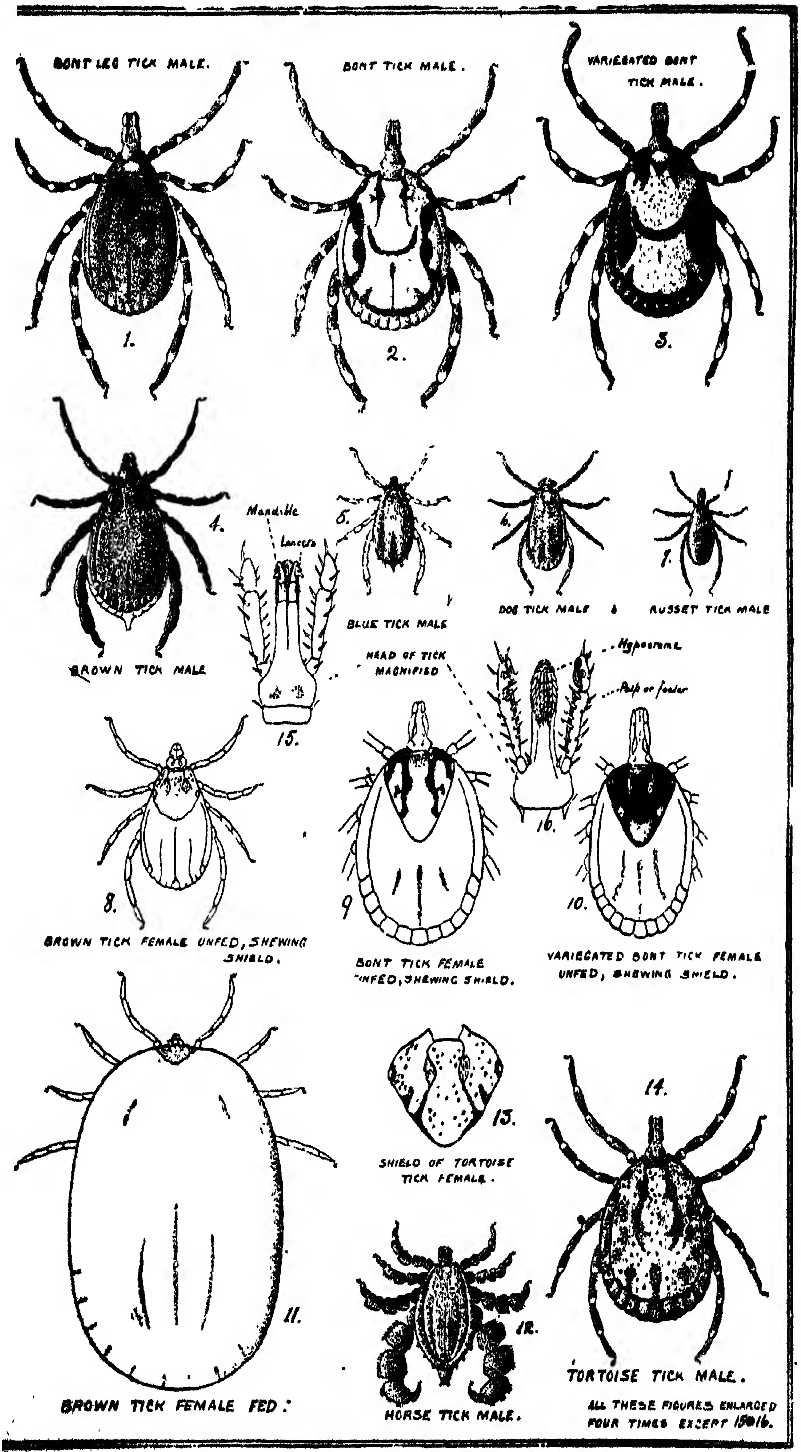

BONT LEG TICK MALE.
1.
BONT TICK MALE.
2.
VARIEGATED BONT TICK MALE.
3.
4.
BROWN TICK MALE
Mandible
Lancets
15.
5.
BLUE TICK MALE
6.
DOG TICK MALE
7.
RUSSET TICK MALE
HEAD OF TICK MAGNIFIED
Hypostome
Palp or feeler
16.
8.
BROWN TICK FEMALE UNFED, SHEWING SHIELD.
9
BONT TICK FEMALE UNFED, SHEWING SHIELD.
10.
VARIEGATED BONT TICK FEMALE UNFED, SHEWING SHIELD.
13.
SHIELD OF TORTOISE TICK FEMALE.
14.
TORTOISE TICK MALE.
11.
BROWN TICK FEMALE FED.
12.
HORSE TICK MALE.
ALL THESE FIGURES ENLARGED FOUR TIMES EXCEPT 15 & 16.

Plate I.

The life history of the Bont-leg tick is of the two host type, the moult between the larval and nymphal stages being passed on the host, and that between the nymphal and adult on the ground.* Although the adults are common parasites of cattle and other stock, the larvæ are not known to attach themselves to these animals, but have been reared successfully on rabbits and fowls. To these hosts they attach themselves in the region of the head. The common hare is no doubt a great factor in keeping up the numbers of these ticks on cattle runs, but other rodents must play a part, and in any case the range of hosts of the tick in its early stages is imperfectly known.

The Bont-leg tick has not as yet been found guilty of transmitting any specific disease in Southern Africa. Its attack, in the adult stage has, however, a notorious tendency to cause abscesses and sloughing of the skin, and spots affected in this manner are believed to be specially liable to form the starting points for attack by the so-called "Screw Worm" (*Chrysomyia bezziana*, Villen.) which causes so much trouble amongst cattle.

The African hosts recorded for the adults of this species include the domestic ox, Cape buffalo, dromedary, rhinoceros, horse, ass, giraffe, sheep, goat, pig, dog, cat, man, domestic fowls and ostriches. The larvæ and nymphs are recorded from hares, rabbits, fowls, ostriches and other birds.

The Bont Tick (*Amblyomma hebræum*, Koch).—The male of this species is easily recognised by the pattern on the shield, the dark markings being dark brown, nearly black, and the lighter portions pale green in the middle merging into yellow towards the edges (see Plate I., fig. 2). The legs are banded as in the preceding species. In the female the markings on the shield are more variable. The plan of the markings on a specimen in the Departmental collection is shown at fig. 9 on Plate I. The remainder of the back of the tick in the unfed female is dark brown.

*It has been shown that this species may or may not drop off for the first moult, so that its cycle is of either the two host or three host type. Individual variation in habit of this nature has not been noted in connection with other ticks.

The length of the males and unfed females, including the mouth-parts, is about one-quarter of an inch, and the breadth about three-sixteenths of an inch. The engorged female usually measures about three-quarters of an inch long by five-eighths of an inch in breadth.

The life history of the Bont tick is of the three host type, both moults being passed through away from the host. The larvæ and nymphs feed on the same hosts as the adults. The duration of the different stages has been worked out in detail by Mr. C. P. Lounsbury in the Cape Colony. The female tick lays an enormous number of eggs, upwards of 17,000 having been computed in a single batch. The incubation period of the eggs varies very greatly with the temperature. In the winter it may occupy six months or more, and in the summer a period of about eleven weeks has been noted. The larva feeds for from four to nine days, but usually six or seven, before detaching itself, to drop to the ground for its moult. At this stage of its development it measures about one-twelfth of an inch in length. The time occupied in the moulting process varies in relation to the temperature and possibly other factors. It has occupied as little as sixteen days, when the ticks were kept in an incubator, and several months during the winter at ordinary atmospheric temperature. In nature it is thought that the period would vary between one to three or more months. The nymph or second stage tick engorges in from four and one-fourth to eight days, and like the larva drops to the ground for the ensuing moult. Lounsbury mentions periods of eighteen, twenty-two, twenty-four and twenty-eight days for this second moult, but adds that the time varies considerably with individuals, some treated in exactly the same way taking a fortnight longer than others over the process. This second moult brings the tick to the adult stage. The females only bite in readily next to a male that has been attached for some days. They then take some seven or eight days to feed to repletion and drop off to lay their eggs on the ground. The males remain attached to the host for a prolonged period.

As far as the complete life cycle is concerned, Lounsbury judges that in the Cape Colony there cannot be more than one complete generation in a twelvemonth, and that "under

exceptional circumstances two full years might pass and the cycle be still incomplete."

The Bont tick is found mainly in south-eastern and eastern Africa. Until relatively recent years it was not known to occur naturally in Southern Rhodesia, but it has been introduced from the Union of South Africa and is now well established in a number of districts. Its distribution now includes certain parts at least of the following districts:—Charter, Ndanga, Chibi, Victoria, Nyamandhlovu, Bubi, Insiza, Mzingwane, Gwanda, Matobo, Bulalima-Mangwe, Bulawayo and Belingwe.

The above information was kindly supplied by the Chief Veterinary Surgeon.

As far as can be judged at present there are few parts of the Colony which this tick would be incapable of inhabiting.

The Bont tick was originally shown by Lounsbury to be the transmitter of the disease known as Heartwater, which attacks sheep, goats and calves in parts of the South African Union. The tick conveys the disease from stage to stage, and not through the egg, that is to say, larvæ or nymphs which feed on a sick animal acquire the virus of the disease, and the resulting nymphs or adults, as the case may be, transmit the disease when they "bite" susceptible animals.

The Bont tick in the adult stage has been recorded from cattle, sheep, goats, swine and horses, amongst domestic animals, and rhinoceros, giraffe, various antelopes, buffalo, lion, wild dog and other carnivora. It has also been found on a "monitor" lizard.

The Variegated Tick (*Amblyomma variegatum*, F.).—The handsome male of this species is shown at fig. 3 on Plate I., and a diagram of the female illustrating the shield markings at fig. 10. Although the shield markings of the male are on very much the same plan as those of the preceding species, there is no risk of confusing the two. The edges of the shield in the Variegated Bont Tick are dark, whereas those of the Bont tick are pale. Furthermore, the light markings on the shield in the present species are coppery red instead of pale green shading into yellow towards the edges as in the

case of the true Bont tick. Entomologists also find a distinction in the "eyes," which are flat in the Bont tick but prominent and provided with a slight orbit in the "Variegated" species. The dark markings in the present species are also distinctly raised above the general surface of the shield, and there is a green tinge at the edges of these markings. The markings on the female shield are variable, and occasionally the whole shield is dark without any light patches. In size and life h'story, as far as the latter is known, this species resembles the Bont tick, although the engorged females are recorded as attaining even greater dimensions.

This tick is common in the Kalahari sand area of the western districts of the Colony and a very similar form occurs in the eastern border districts and in Mocambique Territory. There is, however, some uncertainty as to the identity of the species occurring in the latter locality, which was originally described by Robinson as a distinct variety under the name of *Amblyomma variegatum* var. *nocens* (Robinson, 1912). This variety was later "sunk" by the same author as a synonym of *pomposum*, Dönitz. The laboratory collection, however, contains specimens of *variegatum* from the western districts which, in series from the same animals taken at the same time, show practically all gradations in the males from typical *variegatum* to typical *pomposum*. Unfortunately there are no specimens of females at present available from the eastern districts or Mocambique Territory There appears, however, to be doubt as to whether *pomposum* is really a distinct species. Neither form is prevalent over the higher portions of the plateau between the eastern and western districts.

This species has been shown to transmit Heartwater. There is also reason to believe that it is responsible for transmitting the casual agent of a disease of cattle, known as "Sinkobe" disease, characterised by the breaking out of sores, followed by extensive sloughing of the skin, on the back, shoulders, neck and below the knee.

The Tortoise Tick (*Amblyomma marmoreum*, Koch).—The male of this species is shown at fig. 14 on Plate I., and the female shield at fig. 13. The adults are common on reptiles, particularly tortoises, hence the popular name; but they also attack warm-blooded animals. The larvæ and nymphs feed very readily on warm-blooded animals. This species was reared at Cape Town during the time the present writer was assistant to Mr. C. P. Lounsbury, and the life history was found to be similar to the Bont tick, each stage dropping from the host for the moults. The engorged females may attain a considerably greater size than those of the Bont tick, and the unfed males and females also average rather larger.

The Tortoise tick occurs in this Colony, but does not appear to be very abundant. It is recorded from the Cape up the east coast to the Congo and in West Africa (Senegal). Neumann records rhinoceros and genet as warm-blooded hosts, as well as tortoise and python.*

Another species of *Amblyomma*, namely, *A. gemma*, Donitz, has been found on a bull in the Umtali district (1932). It is recorded on cattle, rhinoceros, eland, zebra and lion in Kenya.

Amblyomma eburneum, Donitz, has also been taken on cattle in the Melsetter district. Other recorded hosts are buffalo, giraffe, lion and monitor lizard.

Two relatively rare species of ticks recorded of recent years on domestic animals are:—(1) *Rhicipentor nuttalli*, Cooper and Robinson, found on a dog in the Makoni district (1934). This species is recorded on kudu, hedgehog and dog in the Union of South Africa.

(2) *Rhipicentor bicornis*, N. & W., was taken on a dog in Gutu district in 1933. It has been taken elsewhere on cattle and goats.

The Brown Tick (*Rhipicephalus appendiculatus*, Neum.) **and its Relatives.**—The Brown Tick, well known in connection with the transmission of East Coast Fever, is shown on Plate I., the male at fig. 4, the unfed female at fig. 8, and the fed female at fig. 11. There are, however, a number of different species of this genus in the Colony, and most of them resemble the Brown Tick so closely that none but those who have made a study of ticks are likely to distinguish one from the other. With many species even specialists experience considerable difficulty, particularly with the females. The writer has therefore thought it unprofitable to figure more than one species. The Brown Tick is, generally speaking, the commonest cattle parasite of the genus, although the "Black-pitted Tick" (*R. simus*, Koch) is also common on this host, as also is the "Red-legged Tick" (*R. evertsi*, Neum.). The latter is an easily recognised species owing to its saffron coloured legs, the legs of the other representatives of the genus

*This species has since been taken in numbers from rhinoceros in Southern Rhodesia.

being dark brown. The adults of the *Red-legged Tick* attach themselves by preference under the tail of the host, whilst nymphs are mainly found deep in the ears. On this account the nymphs have frequently reached the writer with a request for a statement as to whether they are specimens of the Spinose Ear Tick or not. The adults of the Brown Tick are also found on the ears of their hosts, although they do not penetrate so deeply as the Red-legged Tick nymphs, and are also sometimes suspected of being Spinose Ear Ticks. As will be seen later, both forms are very distinct from this latter species, which belongs to the other family of ticks (*Argasidæ*).

Both males and females (unfed) of the Brown Tick and its local relations (excluding the Red-legged Tick) are of a uniform dark brown colour. The size is variable. The male from which fig. 4 on Plate I. was drawn measures almost exactly three-sixteenths of an inch in length, and this is about the maximum size. Many specimens are much smaller. It is noteworthy that specimens taken from antelope and other wild animals all appear to be on the small side. The specimen figured was taken, in company with others of similar dimensions, from cattle at Salisbury, the unfed females of the same batch being rather smaller.

The name *appendiculatus*, given to this species by Prof. Neumann, refers to the prominent projection on the hinder margin of the male. This may develop, but does not always do so, as the tick feeds, being absent in unfed specimens. Other species of the genus also develop projections, but usually less prominent than that of the Brown Tick. This peculiarity is also found in the genus *Boophilus*, which includes the Blue Tick, to be dealt with later.

The life history of the Brown Tick and several other members of the same genus has been worked out in detail. The other members include the Black-pitted Tick (*R. simus*, Koch), the Cape Brown Tick (*R. capensis*, Koch), and the Red-legged Tick (*R. evertsi*). Of the four species mentioned, three show life histories of the three host type, falling from the host for both moults. The Red-legged Tick has, however, a two host cycle, remaining on the animals for the first moult, but falling off for the second.

The Brown Tick larva may occupy as little as three days in feeding to repletion, but frequently takes considerably longer. When full fed it is about the size of a pin's head, and drops off for its moult, which may take a fortnight or more, depending on the temperature, etc. The resulting nymph, after attaching itself to an animal, feeds to engorgement in some 4—6 days or longer, and again falls off for the moult, being now about the size of a lentil. The female, providing she meets a male at once, swells to repletion in about nine days, and drops off to lay her eggs on the ground. The time occupied by the moults and hatching of the eggs varies greatly with the time of year, and Lounsbury estimates that not more than two full generations can be passed during the year under the most favourable circumstances.

The above notes apply to the other species of the genus which have been studied, with the exception of the Red-legged Tick. In this species the engorged nymphs begin to fall from the ear about ten days after the larvæ have "bitten in," and the larval and nymphal stages are thus passed in a considerably shorter time than in the case of species which fall off for the first moult.

The four species of this genus mentioned above have all been found capable of transmitting East Coast Fever, and it is probable that some, if not all, other members of the genus which feed on cattle are capable of playing a similar part. The method of transmission is similar to that of the Bont Tick and Heartwater. A tick feeding on a sick animal in the larval stage and "biting" a susceptible animal in the nymphal stage may convey the disease, as may also occur if the nymph feeds on a sick animal and the resulting adult feeds on a susceptible animal. The disease does not pass through the egg stage, and recovered animals have under test invariably failed to infect ticks. It is noteworthy that if a larva feeds on a sick animal and the resulting nymph engorges on an animal, such as a dog, hare, goat or sheep, which is immune to the disease, the infection is lost and the adult is not capable of infecting a susceptible animal.

The Brown Tick has been shown to transmit Redwater in cattle either as an adult, which fed on an infected animal in

the nymphal stage, or as a larva, whose mother fed on an infected animal. It can also transmit the form of gallsickness in cattle caused by the organism *Theileria mutans*, but the mode of transmission in this case is not stated.

The Red-legged Tick can also transmit gallsickness caused by *Theileria mutans*. It plays a more important role, however, in transmitting biliary fever of the horse. These diseases are transmitted by the adults which have fed on infected animals in the larval and nymphal stages, both of which, as already stated, are passed on one host. In addition to the above, the larvæ can transmit ordinary Redwater in cattle and the disease known as *Spirillosis* caused by *Spirochæta Theileri*, affecting cattle, sheep and horses, when the mother tick has fed on an infected animal.

The Black-pitted Tick can transmit ordinary gallsickness (*anaplasmosis*) amongst cattle.

The European Brown Tick has been shown in India to transmit malignant jaundice or canine piroplasmosis of the dog, which it may do in three ways, at least:—(1) adult females feed on an infected animal and the nymphs of the next generation are infective; (2) nymphs feed on an infected animal and the adults are infective; and (3) adult females feed on an infected animal and the adults of the next generation are infective.

It will be seen, therefore, that ticks of the genus *Rhipicephalus* are amongst the most important in regard to disease transmission.

A list of the ticks of this genus which are known to occur in Southern Rhodesia is given in the continuation.

The Blue Tick (*Boophilus decoloratus*, Koch).—This species is readily distinguishable from other common cattle ticks by its pale legs. The male and unfed female are considerably smaller than the species already dealt with, although the fully engorged female is not so markedly inferior in size to the engorged Brown Tick female. The male measures roughly about one-eighth of an inch in length, and is of a greenish blue colour, with a well developed "tail" when fed, as in the Brown Tick. The points of the plates on the under surface

of the body frequently show when the fed male is viewed from above (see Plate I., fig. 5). The fed female is somewhat greenish blue in colour in contrast to the slaty blue of the Brown Tick female, and the shield is smaller. The easiest guide lies, however, in the pale legs.

The life cycle of the Blue Tick is confined to a single host, the tick remaining in position for *both* moults. The cycle is a rapid one compared with most other ticks, as the natural heat of the host causes the tick to be much less influenced by the weather during the moults. The fully fed females usually commence to fall about twenty-one days after the larvæ have "bitten in," but the bulk appear to mature getween the twenty-third and the twenty-fifth day. The female, of course, lays her eggs, like other ticks, on or in the ground, and their hatching period is influenced by atmospheric conditions. Under natural conditions there are, however, undoubtedly several generations during the year, and in the absence of dipping the Blue Tick is, as a rule, the commonest species. On the other hand, where dipping is practised it tends to disappear sooner than any other species on account of the lengthy period it spends on its host at a time, which exposes it to repeated immersions.

The Blue Tick transmits the cattle diseases Redwater and Gallsickness (*anaplasmosis*). It has also been shown to be an agent in the transmission of *Spirillosis*, affecting horses, cattle and sheep. The disease is taken up by the tick when feeding on a sick or recovered animal, and is conveyed by the larvæ of the next generation when they attach themselves to a susceptible animal. The infection thus passes through the egg stage.

This species has been recorded on the following animals: —Ox, horse, sheep, goat, dog, koodoo, impala, sable antelope.

The Horse Tick (*Margaropus winthemi*, Karsch).—This relative of the Blue Tick is not known to occur in Southern Rhodesia. It is a South American species, and probably came to Africa with horses from the Argentine during the Boer War. Little is known concerning its habits. It was first found in South Africa infesting horses in the Cape Colony, and was described by two separate authorities as a new species under the names of *Rhipicephalus phthirioides*,

C. & R., and *Margaropus lounsburyi*, Neum. The bizarre form of the male (see Plate I., fig. 12) suffices to distinguish it from other known ticks, but the females are superficially similar to, although somewhat larger than, the common Blue Tick. The legs have, however, a striped appearance through the presence of dark markings towards the outer end of each article.

The tick has been recorded on horses and cattle and has been introduced to this Colony in the past.

The Dog Tick (*Hæmophysalis leachii*, Aud.).—This is the commonest tick found on the dog in this Colony as elsewhere in South Africa, but dogs are sometimes seen more heavily infested with *R. sanguineus* or *R. simus* adults.

The male of the dog tick (see Plate I., fig. 6) is about the same size as that of the Blue Tick, but is of a uniform brown colour, including the legs. The engorged female attains very much the same size as that of the Blue Tick, but is more slaty blue in colour. Although distinguishable at a glance from the Brown Tick and its allies to those familiar with the characteristics of ticks, there is no very broad distinction to guide the uninitiated. The "head" of the Dog Tick is, however, shorter and broader than that of the Brown Tick, and the male does not develop a "tail."

The life cycle of the Dog Tick is of the three host type, the tick falling off for both moults. There are probably two generations during the year as in the case of the Brown Tick.

The Dog Tick is known to transmit the diseases known as Malignant Jaundice or Canine Piroplasmosis. The mode of transmission, discovered by Mr. C. P. Lounsbury at the Cape, is unique. Adult females fed on a sick or recovered animal take up the infection, but the larvæ and nymphs of the next generation are, as a rule, incapable of transmitting the disease. When the adult stage is reached, however, the ticks are infective and capable of giving the disease to a susceptible animal, if they happen to attach themselves to such.

The hosts recorded for this tick are mainly carnivora, namely:—Domestic dog, jackal, domestic cat, lion, leopard, genet, civet-cat, mongoose and scaly ant-eater.

The Russet Tick (*Ixodes pilosus*, Koch).—The popular name given to this species refers to the colour of the males and unfed females. It is an uncommon species in Southern Rhodesia. The males measure about one-tenth of an inch in length including the mouth-parts, and the species is the smallest with which we have to deal. The engorged female is of a distinctive shape, being considerably broader behind than in front. The male is figured on Plate I. at fig. 7, and may be recognised by its small size, the long narrow mouth-parts, the brown colour, the deep groove round the shield, and the absence of festoons on the posterior part of the shield. The long narrow mouth-parts and the colour also serve to distinguish the female. This species was reared years ago, by Mr. C. P. Lounsbury at the Cape, and found to drop off for both its moults, having thus a three host cycle. All the specimens in the departmental collection were taken on the domestic dog. The Russet Tick causes a disease of sheep and goats of the nature of paralysis, from which the animal rapidly recovers after removal of the tick, care being taken to remove the mouth-parts completely.

In addition to the dog the following hosts are recorded, and it may be stated that experience elsewhere does not indicate the dog as necessarily the favourite host, the tick being found abundantly on cattle and small stock—cattle, mules, horses, pigs, goats, sheep, bushbuck, duiker, cat and leopard.

Besides the ticks we have dealt with, a number of other species of the family *Ixodidæ* have been found in the Colony, but as they are not known to feed upon domestic animals they have only been included in a list at the end of this article.

(To be continued.)

Brief Notes on Respiratory Diseases of Poultry and their Treatment.

By THE POULTRY BRANCH.

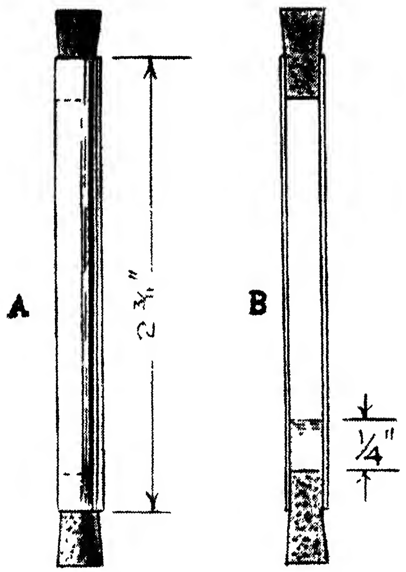
Introduction.—The respiratory organs of birds, consist of the nasal passages, the pharynx, larynx, trachea, lungs and the air sacs.

For several reasons which need not be explained here, the respiratory apparatus in birds is more efficient than in mammals, but mainly because fresh air is available for aeration of the blood, whereas in mammals residual air is used. Air penetrates further in birds to the sacs or reservoirs which extend to the muscles and even penetrate some of the bones, thus helping to reduce the weight of the body in flight. A very important fact to remember in regard to the efficient housing of poultry, and also in other respects, is that the respiratory apparatus of birds, in addition to aeration of the blood, also eliminates most of the waste moisture of the body and is consequently, the temperature regulator. Birds have no sweat glands to perform this function, and the secretion of the kidneys contains relatively little moisture. Lack of knowledge on this point and the faulty housing conditions and overcrowding, due to this ignorance, are responsible for many of the respiratory diseases from which poultry suffer. Exposure to unfavourable conditions also reduces the vitality of the birds and their ability to resist infectious diseases.

ASPERGILLOSIS (MYCOSIS OF THE AIR PASSAGES).

This disease is not common in Rhodesia but may be mistaken for tuberculosis as it is a frequent cause of "going light."

Diagnosis.—The disease affects chickens and adult stock. Loss of appetite and abnormal thirst are noticed, the bird



A Empty blood pipette with corks in position
B. Section of a pipette showing amount of preservative required
C Section of a pipette full of blood and preservative

Position of bird during collection of blood.

becomes inactive with head down, eyes closed, wings drooped and plumage roughened. Lameness with swollen joints also may be observed. There is a rise in temperature and increased rate of respiration followed by laboured breathing and rattling. There is diarrhoea and emaciation followed by death in from one to eight weeks. A certain diagnosis requires the identification of fungous filaments and spores.

Cause.—The disease is caused by moulds which grow on the mucous membrane of the air passages. These moulds and their spores are found on dead organic material such as straw, litter, grain etc. They are inhaled in breathing or swallowed with the food. The importance of avoiding musty or dirty litter in the houses or mouldy or musty food of all kinds should be borne in mind.

As with other diseases, some individuals have a higher resistance than others. It seems that this disease may be transmitted through the eggs.

Treatment.—No cure is known. Prevention can be secured by having clean, dry, well ventilated houses and avoiding the use of mouldy litter or grain. Affected birds should be killed and the bodies burnt.

BRONCHITIS (CROUP) and PNEUMONIA (CONGESTION OF THE LUNGS).

Inflamation of the mucous membranes of the bronchial tubes may frequently follow catarrh or colds.

Diagnosis.—The symptoms are those of severe catarrh with rapid breathing and cough. In the early stages a whistling sound is made when breathing which later develops into a rattling or bubbling sound especially noticeable at night. From this stage the bird may recover or the symptoms may become chronic when loss of weight will occur. Sometimes the disease advances until food is refused, the wings droop, breathing becomes more difficult and finally death occurs.

Cause.—Bronchitis and pneumonia may follow a cold or may be caused directly by exposure to cold, draughts, dampness sudden changes in weather, overcrowding, dust or irritating vapours.

Treatment.—Cases should be placed in a warm well-ventilated but not draughty room. Feed soft food only, such as bread or bran and pollard moistened with milk. Honey and warm water may be given several times a day and affords relief. Severe cases may be given 3 to 6 drops of either syrup or wine of Ipecacuanha once a day, or one grain of quinine may be given up to three times daily. Care must be taken not to irritate the trachea when administering medicines. If more than an occasional case occurs in the flock attention should be paid to the housing and management.

ROUP OR INFECTIOUS CORYZA OF FOWLS.

No avian disease is so misunderstood by the public as true roup or infectious coryza, and it is the most common ailment encountered. This utter confustion may be ascribed to several factors. In the first place the symptoms may be extremely varied. Secondly until a few years ago, scientific workers frequently confused it with other diseases, about which a great deal more is now known. Finally almost every writer gave it his own pet name, e.g. contagious catarrh, canker, "swollen head," ocular roup, cold, swollen eye, diphtheria, diphtheritic roup, "pip" and bronchitis.

Manifestations of Infectious Coryza.—Infectious coryza is a specific disease of fowls, turkeys, ducks and pigeons closely resembling influenza of the human being. It is very infectious, and the incubation period is about four days. It manifests itself in a number of ways, each of which is described hereunder: —

The Acute Form.—This is the form usually seen in ducks and pigeons, and often also in fowls and turkeys. A number of birds stand moping, with bedraggled feathers, bluish combs and perhaps slight diarrhoea. A few struggle to breathe, and these may drop suddenly, flap the wings violently, and die of suffocation. Most of the affected birds succumb within a week, and the outbreak will recall the disastrous human influenza epidemic at the close of the Great War.

If a dead bird be opened carefully, the flesh is found to be darkish-red in colour, and it and the internal organs will

look as if they have been sponged with glycerine. This glistening effect remains even for a long while after exposure to the air. Just inside the entrance to the windpipe, those that "gaped" or died of suffocation will show a plug of dirty cheesy material, and where the windpipe divides to send a branch to each of the lungs, another similar plug may be found. Turkeys are said to be hard to rear, especially when "shooting the red," and most of the deaths are really due to this form of roup. Farmers sometimes accuse chicken pox vaccine of killing their fowls, yet in practically every case the mortality is found to be due to the acute form of roup, and chicken pox vaccine will not protect fowls against roup.

Simple Nasal Catarrh.—This is the mildest form in which roup appears. The nose runs, and the bird sneezes and wipes the nose on the neck hackle feathers. Later the nose may become blocked, and the fowl then breathes through the mouth. There may be a bad smell, but the smell is due to different complicating bacteria, and is of no significance. Recovery takes place in a week or more, if no complications supervene.

Pip or Pips.—If the bird has been forced to breathe through the mouth for a long time owing to lack of attention, the tip of the tongue gets dried out. Well-meaning but misguided people promptly nip off the end of the tongue, and make the unfortunate fowl suffer unnecessary pain. What they should do is to clean out the nostrils, and apply vaseline, or similar material to the tip of the tongue till it becomes soft again.

Conjunctivitis.—One or both eyes may get red and swollen, and gradually close. The surrounding skin and underlying tissues may also swell markedly. Cheesy material accumulates inside the lids, and eventually the eye may be lost.

Inflammation of the Infraorbital Sinus.—This is a common complication of simple nasal catarrh, or of conjunctivitis. From the inside corner of the eye-socket runs a canal, which opens in the cleft in the roof of the mouth. Just below the eye is a cavity, or sinus, in the bone, and this opens into the canal mentioned. It is easy now to understand how infection can be set up in the sinus, and when it is inflamed

it often bulges right out below the eye. Anybody who has had antrum trouble will appreciate better what this means.

Sores in the Mouth and Throat.—This is often referred to as pharyngitis. Little pimples and ulcers form, and sometimes the cheesy exudate covers larger patches of the membrane. The membrane itself has a bluish-red hue, instead of a normal healthy red colour. The smell is often repulsive.

Laryngitis.—This is due to an inflammation of the entrance of the windpipe. As already stated, it is frequently a feature of the acute form of the disease, but it may occur in the absence of other lesions. Cheesy exudate gradually blocks up the windpipe and death follows from suffocation, after laboured breathing.

Bronchitis and Pneumonia.—These dreaded conditions are more likely to be encountered in the acute form of the disease. The air tubes in the lungs are plugged with cheesy material, and the lung substance may be dark and frothy. There is laboured breathing, and death usually follows very soon.

Aerocystitis.—Just behind the lungs are two large sacs called the abdominal air-sacs. They are lined by a fine transparent membrane and are usually overlooked. There are other sacs too but these will not be noticed by the majority of farmers. If these abdominal air-sacs are affected, they look like cheesy abscesses behind the lungs. Perhaps only the lining membrane will be thickened and yellowish. If the aerocystitis is severe, the bird apears dull, and every minute or so takes a very deep breath. Recovery may occur in a month or may take longer.

Mastoiditis and Inflammation of the Middle Ear.—The reader will now be aware how similar roup is to influenza of man, and just as in man mastoiditis may complicate influenza so in the fowl we have the identical lesion. Only a few fowls develop the condition. The bird usually stands with the head twisted, one ear often being almost pressed to the ground. If the fowl is lifted a foot or two and then dropped, it behaves as if it had been decapitated. The condition usually gets worse, and ends in death in a month or so.

So far we have described, as it were the various constituents of roup. In any one outbreak most of the birds are affected alike, e.g. the birds may show a combination of laryngitis and earocystitis, or a combination of nasal catarrh and pharyngitis, or there may be just conjunctivitis, or the disease may appear in the acute form.

PREDISPOSING CAUSES

We shall now consider the predisposing causes, i.e. those factors that make a fowl more susceptible to roup. They are, sleeping in a draught; damp, cool quarters; excessively hot quarters; *overcrowding;* too little space between the perch and the roof; lice, worms; improper food; insufficient sunshine; dusty litter; wrong aspect and other debilitating conditions. Just as influenza sweeps away the slum dwellers, so does roup decimate the flocks of poultry slums.

Is a recovered bird immune? Opinions vary, but experience indicates that an attack often confers immunity for about four to six months.

Is there an effective vaccine? No.

Is Chicken Pox vaccine of any use? It will *not* prevent true roup. It will prevent only Chicken Pox and those lesions due to Chicken Pox which resemble many of the lesions of roup. Roup and Chicken Pox sometimes occur together, and this fact has led to many mistaken ideas.

Diseases Mistaken for Roup.—Diseases that are often mistaken for Roup are the following:—

Chicken Pox, in which the eye, mouth and throat lesions are very similar, but if you see pustules and warts on the comb or skin, you can conclude Chicken Pox is present.

Avitaminosis "A," in which the eye, mouth and throat lesions suggest roup. It is found only when white maize instead of yellow, is fed, and the fowls are at the same time not getting any green food. These facts will at once suggest whether you are dealing with true roup or not.

Infectious Laryngotracheitis.—This disease, fortunately, does not occur in this country. In addition to the usual lesions of roup, there is usually bloody mucus in the windpipe.

Visceral Gout, Typhoid, Cholera, etc., may all easily be confused with the acute form of roup. Roup may be suspected if the dirty cheesy plug is found in the windpipe. Professional guidance, however, should be sought.

Gapeworms.—These worms cause gaping, and farmers often suspect their presence when the obstruction is due really to cheesy exudate caused by roup. They are very rare indeed in South Africa, and should not be incriminated unless they are actually found in the windpipe.

DEALING WITH AN OUTBREAK OF ROUP.

As already noted, there is no reliable vaccine. A farmer must aim at preventing cases by other means, e.g. keeping the birds free of worms and lice, not letting them sleep in a draught, avoiding overcrowding, and feeding proper rations.

Even on the best poultry farms, however, roup may break out, and daily individual treatment is then essential. This sounds laborious, but it is amazing how quickly a satisfactory routine method of treatment is evolved. The affected houses should be cleaned and disinfected using new litter and all the drinking water should be lightly coloured with permanganate of potash until the disease is eradicated.

Unless numerous cases develop at once, the sick birds should be isolated in warm, dry, well ventilated coops that are not in a draught. Sick birds should not be much exposed to direct sunlight, because it is harmful to feverish subjects, and a little exercise should be allowed. On the first day of treatment a dose of Epsom Salts may be given—a small level teaspoonful of crystals dissolved in a little water. The diet should be light, consisting of green food, sour skim milk and a little moist mash.

INDIVIDUAL TREATMENT.

After locking the wings hold the bird under the left arm with the breast uppermost, and the head hanging down in front of you. By resting your left foot on a box, you will find you have complete control of the bird, while your right hand is free to wash the head, etc.

Wash the whole head and eyes, and clean the nostrils out with a 1 per cent. carbolic solution, or warm permanganate of potash solution. In the early stages use a syringe without a needle to clean out the soft mucous in the nostrils. Place the syringe in the cleft of the roof of the mouth and syringe through the nostrils. Reverse the process, syringing through the nostrils and out of the cleft. Use warm saline solution or a dessertspoonful of salt or Epsom Salts to one quart of water. This solution is also effective for sore eyes and may be followed by 3 drops of 10 per cent. Argyrol in the eye. After cleansing the nostrils medicinal oil may be injected with the syringe. Any chemist will make this up as follows:—

Oil of Thyme	30 drops.
Oil of Eucalyptus	30 drops..
Menthol crystals	10 grains.
Paraffin	2 ounces

Scrape any cheesy material out of the mouth, throat and entrance to the windpipe. Paint the entrance to the windpipe with a drop of paraffin or turpentine, and then treat the mouth and throat lightly with ordinary tincture of iodine. Now take a small feather, dip it in the 1 per cent. carbolic solution, and insert its end in the front section of the cleft in the roof of the mouth. It will enter a small canal and pass through to the inside corner of the eye socket, where it will be seen pushing against the eyelid. Move the eyelid aside, grasp the feather, and pull it right through. This action will clean out the canal. Then clean out the canal on the other side in the same way.

If there is a bad swelling below the eye, it must be opened with a clean sharp knife, scraped out and treated with tincture of iodine. In the case of mastoiditis, nothing effective can be done, and the bird should be slaughtered. Few people will diagnose aerocystitis except at post mortem examination, and moreover there is no special treatment.

The treatment of ducks and turkeys is essentially the same as for fowls. Be sure that the ducks have comfortable dry, warm quarters in which to sleep. It is perhaps best to rear turkeys, until they are four months old, on the intensive

system, i.e. keep them in a well ventilated but not draughty, warm, dry house with an enclosed exercising yard adjoining. Incidentally, this method will also prevent other diseases, e.g. Blackhead.

The wise poultryman always makes a provisional diagnosis, and then sends two or three sick fowls to the Veterinary Laboratory for confirmation of the diagnosis.

Treatment is of little avail if the conditions which have led up to the disease becoming serious are not altered or improved. This is the main consideration.

A few colds will often occur with a sudden change of weather and should be treated at once but if they persist and develop into more serious conditions mentioned in this article, then the predisposing causes should be investigated and where fault is found (as it nearly always can be) it must be righted at once. Especially be on guard against overcrowding of stock at all ages.

Some information contained in this article appeared in *Farming in South Africa* to which due acknowledgment is made.

Vegetables have become a front line of our defence. Two of the crops which give the highest yield of food per acre are vegetables and potatoes.—*Sir Robert Greig.*

Costings of Farm Operations
ON THE WITCHWEED DEMONSTRATION FARM, AUCHENDINNY, SEASON 1940-41.

By S. D. TIMSON, Assistant Agriculturist; G. L. BLACK, Dip. Agric. (Durham), Manager.

Below are shown the costings of the more important operations during the second cropping season (1940-41) since the farm was taken over by the Department in January, 1939.

In a previous article on the costings of the first season published in the *Rhodesia Agricultural Journal* in July, 1941 (reprinted as Department Bulletin No. 1176) the history of the farm, and a brief description of it, and the system of costings employed is given. It is considered advisable, however, to point out once again that the costs included are what may be called the "cash costs," or the farmer's "out-of-pocket expenses." They include the actual costs of labour and rations, fertilisers, seeds and seed treatment, and stores such as bags, twine, seed disinfectants, fuel and oil for shelling maize, etc.

Costs which are not included are those of maintenance and depreciation on implements and tools, the cost of ox-labour, and the cost of European supervision. It may, perhaps, be mentioned in this connection that the cost of maintenance and depreciation on implements and tools on the Gwebi Farm, per acre of maize grown in the season 1928-29, was 4s. 3d. and the cost of ox-labour was 5d. per acre for the same crop.

No charge is made against the maize crop for the cost of trap-cropping or green-manuring, since it is considered that on this farm, at present, it is more properly a charge against capital expenditure, and should be included eventually in the value of the land, being added to the price at which the farm was taken over. The severity of the infestation of the arable land by witchweed, and the exhaustion of the

inherent fertility of the soil, rendered the farm practically unsaleable at the time it was taken over; certainly to any experienced farmer who was aware of its condition in these respects. In other words, the capital value of the arable land, which from the farmer's point of view is its fertility or power of producing crops, had become depreciated to a very low level. At present the chief object in the operation of the farm is the reclamation of that capital value or fertility, so as to bring it back to a point where the profitable production of crops, particularly maize, is again possible.

In the first article on these costings it was mentioned that it was not considered equitable to charge the cost of labour lost owing to the interference of weather solely to the field or crop immediately concerned. As an example, during the season under review the cost of labour lost in this way on Field No. 11 amounted to a total of £11 10s. 2d., or 4s. 9½d. per acre, whereas on the other main field under maize, there was no labour lost owing to rain.

It is now thought that the cost of all labour lost in this way on the fields under maize should be charged, pro-rata according to acreage, to all the land under maize. If this is accepted as a sound principle then in the season under review the total loss of labour (including rations), namely, £11 10s. 2d., should be distributed over the total acreage under maize, namely, 137 acres, and the cost per acre will then be 1s. 8d., and this sum should be added to the cost per acre in the tables of costings given below.

The average cost of production of maize over the 125 acres reaped for grain may be of interest. It was £1 16s. 11d. per acre, or 5s. 4½d. per bag. The cost of production on the 40 acres of land trap-cropped twice or three times in the previous year may also be quoted in comparison. This was £1 19s. 11½d. per acre, or 3s. 11¾d. per bag. This comparison illustrates the result of the trapping in increasing the yield per acre, and thereby greatly reducing the cost per bag.

The gross cost of trap-cropping has risen from 15s. 8½d. per acre in the previous season to 17s. 6½d. in the present season. This is entirely due to the increased cost of seeds, since the other two items, labour and fertiliser, have been greatly reduced. This is unfortunately due to ignorance of

the fertility of the soils on the farm prior to commencing operations, for the seed plot of Rhodesian Sudan grass was sited on the most infertile and most eroded soil on the farm, and in consequence the supply of home-grown seed (produced at 8s. 7½d. per 200 lbs.) had to be largely supplemented with expensive seed of Amber Cane purchased in the Union at 38s. 6d. per 200 lbs. Had none but farm-grown Sudan seed been used the gross cost per acre of trap-cropping would have been reduced to 14s. 11½d. per acre, and the nett cost (after subtracting the estimated value of the final trap crop which was cut for hay, less the cost of making the hay) would have been 3s. 5½d. per acre.

It would appear, therefore, from the two years costings that the cost of trap-cropping two to three times in one season is moderate, and approximates to the cost of green-manuring with sunnhemp.

It may be mentioned that the trapping of 40 acres of severely infested land in 1939-40 was seen in the season under review when the land grew maize (see under Field No. 17 below) to have been extremely successful, since it was only with difficulty that the few widely scattered plants of the parasite could be found, with the exception of a small patch of about one-eighth of an acre. This 40 acres was reported by the previous lessee, and neighbouring farmers, to have been so severely infested with witchweed previously that it was no longer profitable to grow maize on it.

In March a very severe wind-storm blew down much of the maize. In order to allow machine cultivation to be continued the wind-blown maize was tied up by hand at a cost of 3.04d. per acre over an area of 125 acres of maize. Machine cultivation by single oxen in head-harness was thus able to continue until the witchweed stopped growing.

Labour and Wages.—The average complement of native labour on the farm during the year was 33, and varied between 39 to 25. Of this number an average of 10 have been available for field work, varying between limits of 12 and 6, and an average of 11 have been employed with the oxen in cultivation, carting, preparation of the land and ploughing in trap-crops.

The average wage paid during the year has been 16s. per month for 26 adults other than drivers; 6s. 3d. per month for 5 juveniles; and 35s. per month for two drivers.

Rainfall.—The general seasonal conditions and rainfall should be considered in connection with the practicability and cost of the various operations.

Although the total rainfall was adequate, its distribution was most unfortunate, and the season proved to be one of the most unfavourable for maize growing that has been recorded in the district.

The maize on Field No. 17 was germinated in the last week in November, and thereafter a drought lasting over three weeks was experienced, which severely affected the maize.

The remainder of the maize (67 acres) was not germinated until late in December, whereafter heavy and continuous rains for about five weeks water-logged the soil and prevented the maize from obtaining its proper nitrogen supply. In addition the seasonal rains stopped abnormally early.

The following rainfall was recorded during the season:—

	Oct.	Nov.	Dec.	Jan.	Feb.	March	Total.
Rainfall in inches	0.63	3.62	8.12	11.83	5.71	3.28	33.21

The junior author has been responsible for the recording of all the costs, and the senior author is responsible for their method of presentation here.

Field No. 17.

Area: 77 acres.
Total yield: 612 bags.
Yield per acre: 7.95 bags.
Spacing: 6 feet by 18 inches.

Crop: Maize following
(1) Trap crops on 40 acres.
(2) Green manure crops on 37 acres, cut for compost.
Date of germination: 27th Nov., 1940.
Fertilisers: Bone meal 150 lbs. per acre on 40 acres; 200 lbs. per acre on 37 acres.

Operating Expenses.

Items.	Cost per acre.	Cost per bag.	Total cost.	No. of labour days.
	£ s. d.	s. d.	£ s. d.	
1. Preparation of land... ...	0 3 0	0 4.53	11 1[illegible] 2	200
2. Fertiliser and application	0 12 11½	1 7.57	49 18 1½	32
3. Seed at 30/- per bag ...	0 3 10¾	0 5.88	15 0 0	
4. Planting by hand	0 1 6	0 2.25	5 15 0½	138
5. Hand weeding, refilling and singling	0 1 3¼	0 1.92	4 18 0	113
6. Cultivation (normal) ...	0 2 10¼	0 4.31	10 19 7	240
7. Cultivation to control witchweed	0 1 4½	0 2.06	5 5 3	120
8. Harvesting...	0 2 6¾	0 3.85	9 17 1½	245
9. Shelling	0 1 1¾	0 1.74	4 8 9½	36
10. Bags, twine and sundry stores	0 6 8¾	0 10.15	25 18 0	
11. Crop guards, cartridges, etc.	0 2 1¾	0 3.24	8 5 4	172
	£1 19 5¼	0 4.11½	£151 16 5	1296 (16.83 p.a.)

Analysis of Expenses.

	Per acre.	Per bag.	Per cent.
	£ s. d.	s. d.	
Labour and rations	0 15 0½	1 11.00	38.14
Seeds	0 3 10¾	0 5.88	9.88
Fertiliser	0 12 7¾	1 6.80	32.06
Stores	0 7 10¼	0 11.84	19.92
	£1 19 5¼	4 11.52	100.00

The comparison of the costs on the two differently treated sections of this field given below serve to emphasise once again the great importance of increasing the yield per acre economically in order to reduce the cost per bag of maize.

Comparison of Operating Expenses of the Trapped and Untrapped Sections of Field No. 17.

Section.	Yield of maize per acre in bags.	Cost per acre.	Cost per bag.
		£ s. d.	s. d.
40 acres Trap-cropped in 1939-40	10.03	1 19 11½	3 11¾
37 acres not Trapped. Green-manured 1939-40	5.70	1 18 10½	6 9¾

NOTES.

Item 2.—Seventy per cent. of the cost of the fertiliser is charged here, and thirty per cent. to the following crop. The residues of the fertilisers applied in 1939-40 to the previous crop are also included.

Item 4.—The spacing was six feet by eighteen inches (two plants per "hill").

Item 7.—The cost of tying up wind-blown maize (1.08 pence per acre) is included here, since this was done to allow mechanical cultivation of witchweed to continue till the end of the season, and thus economise hand labour

Item 9.—The cost of fuel and oil are included.

Item 10.—Second-hand bags at 10d. were used.

FIELD NO. 11

Area: 48 acres.
Total yield: 251 bags.
Yield per acre: 5.23 bags.
Spacing: 6 feet by 18 inches.

Crop: Maize following maize in 1939-40.
Date of germination: 27.12.40.
Fertilisers: 240 lbs. bone meal per acre. Five acres received 10 tons of compost per acre.

Operating Expenses.

Items.	Cost per acre.	Cost per bag.	Total cost.	No. of labour days.
	£ s. d.	s. d.	£ s. d.	
1. Preparation of land ...	0 2 1¼	0 4.80	5 0 6¼	106
2. Fertiliser and application	0 10 5½	2 0.02	25 2 4¼	14
3. Compost and residues...	0 1 9½	0 4.11	4 6 0	
4. Seed	0 2 7¼	0 5.98	6 5 0	
5. Planting	0 1 3¾	0 3.00	3 2 10¼	71
6. Cultivation (normal) ...	0 2 3	0 5.16	5 7 11½	122
7. Cultivation to control witchweed	0 3 0½	0 6.98	7 6 1¼	165
8. Harvesting...	0 2 4¼	0 5.42	5 13 4	128
9. Shelling	0 0 5	0 0.98	1 0 5¼	18
10. Bags, twine and sundry stores	0 4 5¼	0 10.18	10 12 11	
11. Crop guards	0 2 2½	0 5.05	5 5 8¼	103
	£1 12 11¾	6 3.68	£79 3 2	727 (15.14 p.a.)

Analysis of Expenses.

	Per acre.	Per bag.	Per cent.
	£ s. d.	s. d.	
Labour and rations	0 13 7	2 7.17	41.37
Seeds	0 2 7¼	0 5.98	7.84
Fertiliser and Compost	0 12 0	2 3.53	36.38
Stores	0 4 9½	0 11.00	14.41
	£1 12 11¾	6 3.68	100.00

NOTES.

Item 3.—In the previous year (1939-40) 15 acres received a dressing of 10 tons per acre and 25 per cent. of the cost of making and spreading it is charged to the present crop. In 1940-41 five acres received a similar dressing, and 60 per cent. of the cost of this is charged against the crop.

Item 4.—The quantity used cannot be stated exactly, and it is, therefore, estimated at 20 lbs. per acre. Its value is placed at 25s. per bag, since it was somewhat inferior to that planted on field No. 17. See note on item 5.

Item 5.—Twenty-two acres were planted by hand at a spacing of 6 feet by 18 inches (2 plants per hill), and the remaining 26 acres were planted by machine at a spacing of 6 feet by 9 inches.

Item 6.—Thinning to two plants per hill is included.

Item 7.—In this is included the cost of labour employed on tying up wind-blown maize after a severe storm, in order to allow mechanical cultivation of witchweed to continue until April, thereby greatly economising hand labour. The cost was 6.19 pence per acre.

Item 9.—The cost of oil and fuel (4s. 6d.) is included here. The engine consumes "Diesoline" fuel.

Item 10.—Second-hand bags at 10d. each were used.

Item 11.—This is the cost of labour and cartridges for the destruction of wild pigs and monkeys, which were very troublesome.

Comparison of Operating Expenses in the Seasons 1939-40 *and* 1940-41 *on Field* 11 (*Section A*).

Season.	Yield per acre in bags.	Cost per acre.	Cost per bag.	Remarks.
1939-40	2.75	£1 2 10	8/3½	Maize planted 4.12.39 season not unfavourable.
1940-41	8.11	£1 12 11¾	4/0¾	Maize germinated 27.12.40. Season very unfavourable.

Note.—This section of Field No. 11 is 22 acres in area. In 1939-40 the infestation by witchweed was very severe, as is shown by the average count of the parasites per square yard, which was 182 In 1939-40 ten acres were dressed with 10 tons per acre of compost, which was only partially rotted and, in consequence, had no apparent effect on the growth of the maize. In 1940-41 a further 5 acres received the same rate of treatment of well rotted compost.

In 1940-41 the effect of both applications of compost was very evident, both in the growth of the maize and in the great reduction of witchweed as compared with the controls, which received no compost in either year.

It is considered that the increased yield, and consequent great reduction in the cost per bag is to be largely credited to the effect of the compost in improving fertility of the soil, and also to its effect in protecting the maize against attack by the witchweed.

TRAP-CROPPING.

FIELDS NOS. 7 AND 9.

Area: 72 acres.

Seeding rates: Sudan 20 lbs. and Amber Cane 25 lbs. per acre.

Crops: On 40 acres one trap of Rhodesian Sudan and two traps of Amber Cane. On the remaining area two traps of Amber Cane. With the last trap, 12 lbs. per acre of Sunnhemp was sown over the whole area.

Gross Operating Expenses of Trap-Cropping.

Items.	Cost per acre.	Total cost.	No. of labour days.
	s. d.	£ s. d.	
1. Preparation of land	2 10¾	10 8 9	144
2. Sowing and covering seed ...	0 11½	3 8 6	56
3. Killing Sudan by disc-harrow and sowing and covering seed	0 2¾	0 17 6	25
4. Killing trap by ploughing and disc harrowing	2 0¼	7 5 6½	130
5. Sowing and covering seed ...	0 7½	2 5 0	52
6. Hoeing to kill re-growth ...	0 0¾	0 4 3	5
7. Seed and cartage	8 10½	31 18 7½	
8. Fertiliser residues...	1 10½	6 14 0	
Gross operating expenses	17 6½	£63 2 2	412 (5.72 days per acre)

Analysis of Operating Expenses.

	Per acre.	Per cent.
	s. d.	
Labour and rations	6 9½	38.78
Seeds	8 10½	50.60
Fertiliser residues	1 10½	10.62
	17 6½	100.00

The last trap-crop of Amber Cane mixed with Sunnhemp was made into hay, and the costs of this operation are given in the table below.

Area of Traps Cut for Hay: 70 *Acres.*

Items.	Cost per ton.	Cost per acre.	Total cost	No. of labour days.
	s. d.	s. d.	£ s. d.	
9. Mowing	0 7¼	0 3	0 18 0	20
10. Raking and cocking ...	0 3½	0 1½	0 9 0	20
11. Hauling and stacking ...	0 8¼	0 3½	1 0 7	23
12. Fertiliser residues	4 4½	1 10½	6 11 3	
	5 11½	2 6½	£8 18 10	53
			(0.75 days per acre)	

The yield of hay was estimated at 0.43 ton per acre. It was of good quality and was fed to the fattening cattle, who found it very palatable. It is valued at 35s. per ton in the stack, which is conservative, since the feeding value and palatability were considered to be appreciably higher than that of good veld hay, which sells locally at up to £2 10s. 0d. per ton in the winter. In this connection it should be borne in mind that this trap crop hay was cut at a young stage of growth, and was mixed with sunnhemp. Thus, taking into account the estimated value of the trap-crop hay, the nett operating expenses are as shown below.

Nett Operating Expenses of Trap-Cropping.

	Per acre.
Gross operating expenses of trap-cropping	£0 17 6½
Operating expenses in making hay of the last trap-crop	0 2 6½
	£1 0 1
Less value of 0.43 tons of hay @ 35/- per ton	0 14 0½
Nett cost of trap-cropping	£0 6 0½ per acre

NOTES.

Item 3.—This refers only to 40 acres, where three trap-crops were grown and killed. The first crop (Sudan) gave a poor stand, and three weeks drought succeeded germination. The crop was therefore killed by disc-harrowing and the second trap-crop sown and covered by a further disc-harrowing.

Item 6.—Some re-growth of the Amber Cane had to be killed after the final ploughing by means of the hand hoe.

Item 7.—This item is very high. Owing to the poor yield of the farm seed crop of Rhodesian Sudan grass (due to poverty of the soil and erosion) Amber Cane seed was purchased at 38s. 6d. per 200 lbs. Despite the poor yield (0.73 bags per acre) the farm grown Sudan seed cost only 8s. 7½d. per 200 lbs. Had all farm grown Sudan been sown, the nett cost of trap-cropping would have been reduced from 6s. 0½d. to 3s. 5½d. per acre.

Item 8.—This is the residue of 200 lbs. per acre of bone meal applied to the preceding maize crop. Thirty per cent. of the cost of the fertiliser is charged against the trap-crop, but since the final trap-crop was cut for hay, only half of this charge is made against the trap-crop, the other half being charged against the hay crop. The whole cost of the fertiliser is thus finally included in the **nett** cost of trap-cropping.

COMPOST.

BATCH 1: Quantity=170 cubic yards.

System of Making.—This batch of compost was made under rainfall during summer from bedding taken from the open pens in which cattle were fattened for sale. The bedding consisted of some veld grass, but largely a mixture of sunn-hemp and "munga" (Pearl millet) and was used freely enough to keep the cattle reasonably clean. It was left in the pens until the cattle were sold, a period of approximately 143 days from August to December.

The cost of hauling the bedding to the pens was charged against the cattle. The other costs are as follows and are the charges for labour and rations only.

The first turn of the heaps was done in January, the next two turns during February, and the final two turns in March. An extra turn was necessary in February owing to the sodden, compacted condition of the heaps due to heavy rains. The compost was spread on the field in May.

Operating Expenses.

Items.	Cost per cu. yd.	Total cost.	No. of labour days.
	d.	£ s. d.	
1. Cleaning out pens, adding soil and wood ash and building heaps	1.81	1 5 8	29
2. Five turns of the heaps	2.49	1 15 4½	40
Total cost of making compost	4.30	3 1 0½	69
3. Hauling to field and spreading	1.31	0 18 7	21
Total cost of making and spreading on field	5.61	£3 19 7½ (0.53 day per cu. yd.)	90

NOTES.

Item 2.—At the first turn one native turned 12 cubic yards per day; at the second turn and third turn one native turned 28 cubic yards; and at the fourth and fifth turns one native turned 45 cubic yards per day.

Item 3.—The average haul to the fields was 450 yards. The rate of application was ten cubic yards per acre. Hauling was done with an 18 feet pneumatic-tyred steel wagon and teams of only 6 or 8 oxen were required. This reduced the cost by permitting cheap "learner" drivers to be used. The body of the wagon was made of such dimensions that it carries exactly 10 cubic yards of compost. This facilitates application at the correct rate per acre.

System of Making.—Composting the green-manure crop.

This batch was also made under rainfall during summer.

The top-growth from a green-manure crop (a mixture of sunnhemp and sunflowers) was cut with the mower and moved to the side of a temporary cattle kraal erected just off the headland of the field by means of a small tumbling hay sweep and a hay-drag. The crop was nearing maturity when mown, and mowing was not unduly difficult. The crop was about seven feet tall and a good stand. The rates of seeding were 25 lbs. of sunnhemp and 30 lbs. of sunflower seed per acre.

Working oxen were first liberally bedded down with this mixture in the kraal where they slept at night, and thereafter more was added from time to time, until finally the kraal was about 18 inches deep in trampled bedding. Much of the mixture of sunnhemp and sunflowers, particularly the heads

of the latter, was eaten by the oxen. On the arrival of the seasonal rains the kraal was removed and the trampled bedding was built up into compost heaps, with the addition of soil and wood ash. Owing to pressure of other work the first turn was not done until January. Two extra turns were given during the wet spell in January and February owing to the heaps becoming sodden and packed by the heavy rains. Usually three or four turns suffice.

Operating Expenses.

Items.	Cost per cu. yd.	Total cost.	No. of labour days.
	d.	£ s. d.	
1. Mowing	1.45	0 9 8	9
2. Sweeping to side of kraal ...	2.57	0 17 2	12
3. Making up heaps and adding soil and wood ash	0.80	0 5 3¾	6
4. Six turns of the heaps	2.65	0 17 8½	20
5. Hauling and spreading	1.28	0 8 6	10
Total cost of mowing, making and spreading...	8.75	2 18 4¼	57
		(0.71 day per cu. yd.)	

NOTES

Item 5.—The average haul was about 120 yards. This is short, but that is one of the advantages of this system of making compost from the green manure crop, since the compost will normally be applied to the field on the edge of which it is made, and thus carting is reduced to a minimum.

The Farm Home

Preserving Fruit.

A correspondent writes:

The sight of this season's lavish crop of mangoes is a temptation to every housewife. The urge to convert all those hard and heavy fruits into fare for the family, is strong—but too often the right recipe is not at hand and the opportunity is lost. The peach crop in my garden this season has been a poor one, but a few late-bearing trees are yielding well and there is still time to bottle some jars of these, and also of plums for the winter.

Nowadays the preserving of fruit need not be a labour. If fruit is plucked and bottled as it ripens, preserving can take its place in the ordinary routine of the kitchen without disrupting the household and exhausting the housewife. Regular bottling throughout the fruit season, as fruit ripens, rather than one or two isolated bottlings on a large scale when trees are laden with ripe and over-ripe fruit, enables the housewife to preserve greater quantities of better quality fruit and reduce waste due to windfalls, over-ripeness, and the depredations of birds and insects.

For good results in bottling fruit the pint or quart sized "Ball" jars, with rubber rings and screw-top lids, should be used. A good slow fire is required, giving an oven-heat such as is used for the baking of fruit-cakes, or a temperature of 300 degrees Fahr. in an electric oven. The glass jars should be washed in very hot water and placed on a rack in the oven to dry out. The screw top lids and rubber rings should be placed in a basin of hot water until required. When the fruit has been prepared the heated jars are taken from the oven, the rubber rings placed round the necks and the jars filled. First pack the fruit neatly into the jars, then pour in the syrup until they are filled to overflowing. Screw on the lids tightly, then unscrew one half-turn. Place the jars on the rack in the oven over a dish of water and leave at a steady temperature for one hour. After an hour take the

jars from the oven, screw the lids tightly and invert the jars to cool. When cold, wash the jars to remove the stickiness and store in cardboard or wooden boxes in the pantry.

PREPARATION OF THE FRUIT

Mangoes.—Peel and cut up a number of nearly ripe mangoes. Make a syrup (1 part sugar to 2 parts water) and boil the sliced mango in this for $\frac{1}{4}$ hour. Add the juice of one or two lemons, boil again for five minutes, then sieve. Pour into hot jars, screw down lids and place in the oven.

Peaches.—Pour boiling water over a basinful of ripe peaches to loosen the skins. Remove the skins, extract the stones, and pack the half peaches into the heated jars as closely as possible without crushing the fruit. Make a syrup by boiling 1 cup of sugar in 2 cups of water, and fill the jars, (1 pint of syrup should be sufficient for 4 pint jars of fruit). Green peaches must be peeled, stoned, sliced finely, and stewed in the syrup for $\frac{1}{4}$ hour before bottling.

Plums.—Nearly ripe and ripe plums must be washed thoroughly, split and stoned. A syrup consisting of equal measures of sugar and water should be brought to the boil and poured over the fruit in the jars.

For Chutneys and Jams any glass jars may be used and these can be sealed with a layer of candle grease when full. Such jars should be filled to within $\frac{1}{2}$ an inch of the rim, to leave room for the layer of candle grease. Wash the jars in very hot water and dry out in the oven. The hot chutney or jam should be poured into the warmed jars and immediately covered with a cloth wrung out in hot water. The jars must be sealed as soon as cool, to avoid the formation of skins of mould which detract so much from the appearance of some home-made jams.

There need be no waste of candle grease, if the "seals" are removed whole from the jam jars, washed in warm water to remove any jam, and stored in a screw-top jar until the next season. To melt the grease the jar is placed in a pan

of water, brought to the boil, until the "seals" are melted down, and the resulting grease is poured over the next batch of jam.

Mango Chutney.—Large green mangoes, peeled and sliced, 5 lbs.; 1 bottle Vinegar (26 fl. ozs.); Water, 1 pint; Sultanas, ½ lb.; Sugar, 2 lbs.; 5 teaspoons ground ginger; 2 teaspoons salt; 1 teaspoon pepper.

Soak the sliced mango and the sultanas in water over-night. Place the mango and sultanas in a large pan (to allow for boiling up), add one bottle of vinegar and one pint of water in which mangoes have been soaked and bring to the boil. Add the sugar, salt, pepper, and ground ginger. Stand pan to the side of the fire and simmer for 2 to 3 hours, stirring occasionally. When the mixture is thick and all the liquid has been absorbed the chutney is ready. Bottle while hot.

Beans and peas
Are raised with ease,
Tomatoes grow like weeds,
Potatoes too, if only you
Will plant disease-free seeds.

Farming Calendar.

FORESTRY

MARCH.

Cultivation where necessary should be undertaken between the rows of trees planted out in previous months. If cultivation is carried out with the hoe, care should be taken not to pile earth round the base of the stems. New ground for next season's planting should be roughly broken up with the plough. Bulk plantings may be proceeded with during the month.

APRIL.

Cultivate the soil in the young plantations either by means of machines or hand labour. The cultivation will conserve moisture. Hoed out weed growth should be applied as a mulch round the base of each young tree. Be careful not to pile earth round the stems of the young trees. Covering the stems with earth even for an inch or two interferes with the sap circulation and invites attacks by termites.

Steps should be taken to prepare seed beds for the slower growing species, i.e., pines, cypresses and callitris, and seed of these species may be sown from now until the end of June for planting during the coming rainy season.

CROPS.

MARCH.

Plough under witchweed traps in time. Watch oats for rust, and, if badly infested, cut crop for hay as soon as weather permits. Ridge late potatoes, and if weather is dry prevent ridges from cracking, to check tuber moth infestation. Finish ploughing under all green manure crops while the ground is still moist enough to promote rapid decomposition. Cut silage crops and ensile. Cut out barren maize plants and feed to stock or ensile. Cut Sudan grass for hay to permit of final late growth for autumn grazing. Reap any crops that are ready, and plough the stubbles **at once**. Watch for ground nuts making second growth; reap, and when sufficiently dry, place in cocks with nuts inwards and cover the top securely. Watch the weather for hay-making and take advantage of fine spells. Towards the end of the month hay-making should normally be in full swing. Continue to plough all lands in succession immediately the crops are reaped for them. Vleis and irrigable lands should now be ready, or in process of being prepared, for winter crops. Early sowings of winter oats, barley or rye for green forage can be made. Allow any potatoes lifted to dry before storing them, but do not leave too long in the sun. Destroy witchweed and other noxious weeds. Continue to make all the kraal manure possible by throwing grass and litter into kraals, yards, etc. Begin to select in the field maize plants for seed purposes, and mark them with slips of coloured cloth. Press on with the breaking up of any virgin land which may have been stumped or cleared earlier in the year. Place orders for grain bags without delay. Early in the month silage pits should be cleaned out or, where necessary, new pits dug.

APRIL.

Don't forget witchweed cultivation. If sufficiently mature, begin cutting and stooking early maize over a small acreage and plough up the ground whilst still damp between the rows of stooks. Early stooks must be small. Ride your manure and compost to the lands for spreading and ploughing under. If ripe, reap and husk early planted maize, and keep in a separate

dump. Continue to make field selections of the best maize plants, and mark those required for seed with strips of coloured cloth. Lift any ground nuts and potatoes showing signs of making second growth. Make silage; cut maize for this when the ears are in the "dough" stage. Feed sweet potato vines to stock, reserving any new growth of vines for grazing in May. Plough in any green manure crops not already turned under. Plough fallowed land. Keep potatoes reserved for seed on racks in a cool place protected from frost, but well ventilated, and green them in subdued light. Pick over potatoes which may be lifted, and remove the bad and diseased ones. Winter cereal crops for grain can be sown towards the end of the month. Remember that good and deep ploughing to a depth of at least 7 to 8 inches is essential, and the basis of all successful arable farming. If the lands are not already ploughed so deep, increase the depth of ploughing about an inch a year until this depth, or even more, is reached. On lands which have been ploughed for a number of years at the same depth, use a grubber to stir up the sub-soil without lifting it to the surface.

Too much attention cannot be paid to good tillage. It is usually good practice to follow the plough immediately with a harrow or other suitable implement to break down the clods before they bake hard. Continue breaking up new lands; the earlier this is done the more complete is the decomposition of the vegetable matter in the soil. When making hay or coarse legumes such as velvet and dolichos beans and cowpeas, be sure that the vines are dry before stacking. Handle the hay as little as possible to avoid loss of leaf. Lay in supplies of thatching grass for thatching and repairing roofs. The veld may be beginning to dry off. Consideration may be given to mowing or otherwise preparing fire lines as a preventive against veld fires.

STOCK.

MARCH.

Cattle.—Arrangements for winter feed should be pushed on. For a well balanced winter ration, in addition to good quality veld hay, a succulent feed such as maize silage, majordas or pumpkins and a legume hay such as velvet beans, cowpeas or dolichos beans are essential. The milk supply will begin to decrease. In the case of cows rearing calves it is often good policy in this month to cease milking cows and to allow the calves to get all the milk from now on. Slightly increase the amount of grain to the dairy cows and increase the proportion of protein concentrate in the dairy cow mixture to make good the usual loss of feeding value in the grass. Bullocks fattening on grass will do better for a daily ration of some succulent feed such as green mealies or sweet potato tops, unless a supply of green grass is still available.

Calves which are under two months old should be kept in and allowed to nibble at well-got hay; at the same time a little dry mealie meal and monkey nut cake will do them good and teach them to eat concentrates. An ample supply of clean water should be provided in the calf run.

Sheep.—Ewes should now commence lambing. Run the big udder ewes with lambs separate. If the grass has gone off the ewes and lambs should have access to some green feed for an hour or two daily. Continue dosing as for February. If hookworm is present dose now and keep ewes and lambs especially away from vleis.

APRIL.

Cattle.—Where winter conditions are good, early spring calves may be weaned now, but a common practice is to allow them to run with their dams until the early rains. Where supplementary feed is available, April to June are probably the best months of the year for cows to calve in. These months also suit the dairy farmer. Dry off cows which will not pay for a grain ration during the winter. Bullocks for winter fattening should be penned from now on. Steers fat off the grass in April are easily and cheaply topped off.

The season of abundant green pasture is over, and the natural grazing, unless supplemented by some green food or succulent roughage, is not sufficient to maintain a full flow of milk. The most economical supplement to veld grazing at this time is maize silage or green maize, and this should be fed in liberal quantities to all milking cows and growing stock. A few pounds of concentrates in addition would also be of great benefit to the milking cows, which should not be compelled to subsist entirely on veld hay and silage.

Sheep.—See that ewes and lambs have sufficient feed and continue dosing for wireworms and bankrot worm.

DAIRYING.

MARCH.

This is usually the most favourable month of the year for dairy operations. Cooler nights are now in evidence, and there is usually little difficulty in maintaining a low temperature in the dairy and cheese-room. If elementary precautions are taken, all cream should be first grade, and first-class cheese should be made, as a gassy condition of the milk is rare. Dairy cows, unless they are very high producers, can go without extra rations, because the grass is now in seed and grazing is ample. The cheese storeroom is generally full of cheese, and care should be taken to turn the cheese regularly. The windows and doors should be opened at night and closed in the daytime. A little mould on the cheese will not affect its quality, but if the mould is excessive the cheese should be rubbed daily

APRIL.

At this season of the year the milking kraal is generally far from clean owing to the excessive amount of mud or dust which has accumulated during the latter part of the rainy season, and in consequence farmers invariably have trouble in producing first-grade cream. Every endeavour should be made to erect a small milking shed in which four or five cows or more can be milked at a time, and every effort should be made to keep the cows clean. The udders should be wiped before milking with a clean, damp cloth, and the farmer should see that the natives' hands are washed with soap and clean water before and after each milking.

If butter is made, the cream and washing water should be put out overnight, and if the cream is churned early the following morning, very little difficulty should be experienced in obtaining a good grain and a firm body in the butter.

From this time of the year onwards, cheese making operations are usually most successful. The evening's milk should not be kept in the dairy, but should be placed outside and covered over with butter muslin, cheese cloth or mosquito gauze netting. Care should always be exercised, however, in using evening's milk. Morning's milk plus a starter usually gives the best quality, and if a starter is used, care should be taken that it shows no signs of gasiness or off flavours.

VETERINARY.

JANUARY-MAY.

Tick life will be very active and in consequence tick-borne disease in evidence, especially redwater and gallsickness, and in districts where the bont tick prevails heartwater in cattle and sheep must be expected. Regular dipping to destroy tick life and minimise losses from disease should be conscientiously carried out. Horse sickness may be expected during these months and until the first frosts appear, usually about June. Blue tongue in sheep will be prevalent in uninoculated sheep. The inoculation of sheep against this disease should not be undertaken in the wet season unless animals can be kept under cover for 21 days following inoculation, and on account of possible abortion resulting, ewes in lamb should not be inoculated. Screw worm may be prevalent.

GROW MORE

FOOD OF ALL KINDS

FOR VICTORY!

The potato shown above puts its best V forward!

The Twenty-Second Annual Southern Rhodesia Official Egg Laying Test.

Positions are calculated on the total number of 1 14/16oz. and over eggs for the first ten weeks and subsequently on the total 2oz. eggs and over laid by the four leading hens in each pen of five.

SECTION 1: PENS. TWELFTH AND FINAL PERIOD. SINGLE COVERED PENS.
Results from 1st March, 1941, to 30th January, 1942.
Total of four leading hens.

Pen No.	Position.	Owner.	Residence.	Breed.	A.	B.	C.
			HEAVY BREED SECTION.				
2	1	Norfolk Poultry Farm	Umtali	Australorps	948	4	12
4	2	Raynor & Wise	Darwendale	Australorps	877	15	16
6	3	Raynor & Wise	Darwendale	Rhode Island Reds	875	13	7
5	4	Raynor & Wise	Darwendale	Rhode Island Reds	834	9	7
10	5	F. J. Waller	George, C.P.	Light Sussex	826	8	30
11	6	Croaghanmora Poultry Farm	Maritzburg	Buff Plymouth Rocks	825	8	25
* 3	7	E. E. C. Green	Bulawayo	Australorps	793	9	27
* 1	8	Dan Jacobs	Natalspruit	Australorps	779	18	44
7	9	Croaghanmora Poultry Farm	Maritzburg	Rhode Island Reds	759	3	39
* 8	10	Capt. A. G. Waller	Salisbury	Rhode Island Reds	619	25	16
* 9	11	F. J. Waller	George, C.P.	Light Sussex	484	155	159
					8619	267	382
			LIGHT BREED SECTION.				
12	1	E. E. C. Green	Bulawayo	White Leghorns	961	—	3
14	2	W. A. Bull	Umtali	White Leghorns	950	9	16
17	3	A. Beardsley	Bellair, Natal	White Leghorns	942	—	23
22	4	E. J. Speed	Selukwe	White Leghorns	922	—	2
15	5	Ackerman & Birch	Que Que	White Leghorns	912	2	16
18	6	Major W. H. Charter	Umhlali, Natal	White Leghorns	904	8	12
16	7	Dan Jacobs	Natalspruit	White Leghorns	884	2	38
*13	8	A. W. Bull	Umtali	White Leghorns	845	65	51
*19	9	C. J. Marshall	Bulawayo	White Leghorns	759	9	47
20	10	Capt. A. G. Waller	Salisbury	White Leghorns	743	2	12
23	11	E. E. C. Green	Bulawayo	Cambars	688	2	6
21	12	E J. Speed	Selukwe	White Leghorns	657	68	31
					10167	167	257
					18786	434	639

Total number of eggs laid 19,859. *Denotes death.

Positions are calculated on the total number of 1 14/16oz. and over eggs for the first ten weeks and subsequently on the total 2oz. eggs laid.

SECTION 2: SINGLE BIRDS. TWELFTH AND FINAL PERIOD. SINGLE COVERED PENS. Results from 1st March, 1941 to 30th January, 1942.

Bird No.	Position.	Owner.	Residence.	Breed.	A.	B.	C.
			HEAVY BREED SECTION.				
126	1	Croaghanmora Poultry Farm	Maritzburg	Buff Plymouth Rock	251	—	3
120	2	Raynor & Wise	Darwendale	Rhode Island Red	243	4	2
122	3	Croaghanmora Poultry Farm	Maritzburg	Rhode Island Red	234	1	1
121	4	Raynor & Wise	Darwendale	Rhode Island Red	230	—	1
119	5	Raynor & Wise	Darwendale	Australorp	217	1	—
117	6	Norfolk Poultry Farm	Umtali	Australorp	205	—	—
118	7	E. E. C. Green	Bulawayo	Australorp	191	1	2
124	8	F. J. Waller	George, C.P.	Light Sussex	163	—	1
116	9	Dan Jacobs	Natalspruit	Australorp	123	—	—
*125	10	F. J. Waller	George, C.P.	Light Sussex	59	33	35
123	11	Capt. A. G. Waller	Salisbury	Rhode Island Red	9	3	24
					1925	43	69
			LIGHT BREED SECTION.				
128	1	W. A. Bull	Umtali	White Leghorn	269	1	—
137	2	E. J. Speed	Selukwe	White Leghorn	259	—	—
135	3	Capt. A. G. Waller	Salisbury	White Leghorn	248	—	1
134	4	C. J. Marshall	Bulawayo	White Leghorn	242	—	1
127	5	E. E. C. Green	Bulawayo	White Leghorn	235	—	—
129	5	W. A. Bull	Umtali	White Leghorn	235	—	—
131	7	Dan Jacobs	Natalspruit	White Leghorn	209	—	—
130	8	Ackerman & Birch	Que Que	White Leghorn	207	—	1
133	9	Major W. H. Charter	Umhlali	White Leghorn	196	2	1
132	10	A. Beardsley	Bellair, Natal	White Leghorn	167	—	—
138	11	E. E. C. Green	Bulawayo	Cambar	159	4	13
136	12	E. J. Speed	Selukwe	White Leghorn	120	—	3
					2546	7	20
					4471	50	89

Total number of eggs laid 4.610. *Denotes death.

NOTES.

The mortality during this Test amounts to 6.5 per cent. Fifty-one per cent of the birds entered laid 200 and over 2 oz. eggs during the 48 weeks. The best Heavy Breed Pullet, an Australorp, No. 9, the property of Norfolk Poultry Farm, Umtali, laid 263 2 oz. and 1 underweight eggs. The best Light Breed Pullet, a White Leghorn, No. 128, the property of Mr. W. A. Bull, of Umtali, laid 266 2 oz. and 4 underweight eggs

The highest individual totals were:—

Heavy Breeds: Australorp. Mr. Dan Jacobs, Transvaal. Bird no 3 258 2 oz. and 48 underweight — Total 306.

Light Breeds: White Leghorn. Mr. A. Beardsley, Natal. Bird No. 83. 263 2 oz. and 15 underweight — Total 278.

Southern Rhodesia Veterinary Report.

DECEMBER, 1941.

DISEASES.

Anthrax was diagnosed on farm Sunnyside, Insiza district.

TUBERCULIN TEST.

Five bulls and twenty-five cows and heifers were tested on importation. There were no reactors.

MALLEIN TEST.

Two horses were tested with negative results.

IMPORTATIONS.

Union of South Africa.—Bulls 5, cows and heifers 25, horses 2, mules 12, sheep and goats 1,903.

Bechuanaland Protectorate.—Sheep 133.

EXPORTATIONS.

Portuguese East Africa.—Slaughter cattle, sheep and goats 45.

EXPORTATIONS—MISCELLANEOUS.

In Cold Storage.

United Kingdom.—Beef quarters (chilled quality) 79, pork carcases 195.

Northern Rhodesia.—Beef carcases 285, mutton carcases 64, pork carcases 42, veal carcases 4, offal 12,966 lbs.

Belgian Congo.—Beef carcases 135, pork carcases 10, offal 964 lbs.

Meat Products from Liebig's Factory, West Nicholson.

Union of South Africa.—Corned beef 88,704 lbs., tongues 2,286 lbs., vienna sausages 7,901 lbs., ideal quick lunch 16,200 lbs., lunch rolls 1,048 lbs., steak, kidney and onions 1,608 lbs., meat paste 3,700 lbs., Cambridge sausages 4,968 lbs., Oxford sausages 5,232 lbs., cocktail sausages 1,335 lbs., pate de fois gras 395 lbs., ham and tongue 1,165 lbs., chicken and ham rolls 406 lbs., curried beef 240 lbs.

Mauritius.—Meat paste 29 lbs., Cambridge sausages 480 lbs., pate de fois gras 102 lbs., ham and tongue rolls 95 lbs., chicken and ham rolls 315 lbs.

Portuguese East Africa.—Tongues 420 lbs., Vienna sausages 228 lbs., lunch rolls 63 lbs., beef and ham rolls 608 lbs., steak, kidney and onions 120 lbs., beef fat 240 lbs., Cambridge sausages 264 lbs., Oxford sausages 912 lbs., cocktail sausages 90 lbs., pate de foie gras 293 lbs., chicken and ham rolls 16 lbs.

JANUARY, 1942.

DISEASES.

Anthrax was diagnosed at Shumba tank in the Victoria Native Reserve.

TUBERCULIN TEST.

One bull. No reaction.

MALLEIN TEST.

Twenty-six horses. No reactors.

IMPORTATIONS.

Union of South Africa.—Bull, 1; horses, 21; sheep and goats, 1,683.

Bechuanaland Protectorate.—Sheep and goats, 98.

EXPORTATIONS.

Portuguese East Africa.—Slaughter cattle, 120.

Northern Rhodesia.—Bulls, 5; pigs, 2.

Belgian Congo.—Horses, 5; donkeys, 19.

EXPORTATIONS—MISCELLANEOUS.

In Cold Storage.

Northern Rhodesia.—Beef carcases, 414; mutton carcases, 108; pork carcases, 31; veal carcases, 2; offal 14,076 lbs.

Belgian Congo.—Beef carcases, 252; mutton carcases, 16; offal, 1,905 lbs.

Meat Products from Liebig's Factory, West Nicholson.

Union of South Africa.—Corned beef, 6,264 lbs.; meat paste, 1,463 lbs.; assorted sausages, 7,020 lbs.; assorted lunch rolls, 630 lbs.

B. L. KING,
Acting Chief Veterinary Surgeon.

SOUTHERN RHODESIA
Locust Invasion, 1932-42.

Monthly Report No. 109. December, 1941.

THE RED LOCUST (*Nomadacris Septemfasciata*, Serv.) —Reports of locusts during December have referred only to the Mrewa, Mtoko, Inyanga and Umtali districts, all of which are adjacent to the eastern border.

Heavy egglaying has been reported in the Mtoko district.

Monthly Report No. 110. January, 1942.

THE RED LOCUST (*Nomadacris septemfasciata*, Serv.). —Egglaying has been reported in the following districts, namely, Mtoko, Mrewa, Inyanga, Victoria, Ndanga and Chibi.

Hatchings have taken place in the Mtoko and Inyanga districts and are being dealt with.

The egglaying appears to have been on a considerable scale in certain areas.

Egg deposits in parts of Mtoko area and adjacent country are stated to be extensively infested with maggots.

The crops, excluding tobacco, on one farm in the Mrewa district have been destroyed by a large swarm flying from north to south, whilst damage to young native crops has occurred in the Chibi district.

RUPERT W. JACK,
Chief Entomologist.

THE RHODESIA
Agricultural Journal

Vol. XXXIX.] No. 3 [May - June, 1942

Editorial

Notes and Comments

Good Prices for Turkish Tobacco.

We are informed by the Turkish Tobacco Co-operative Company of Rhodesia, Ltd., Darwendale, that a bonus of one penny per lb. will be paid on the crop at present held in store or in course of shipment by the Company. Further, the following bonuses will be paid on the 1941-42 crop (American Grades):—

On the first 500,000 lbs.	1½d. per lb.
On the next 250,000 lbs.	2½d. per lb.
On all over 750,000 lbs.	3½d. per lb.

An influential tobacco company in America has contracted to take all Turkish tobacco of American Grades at eighteen pence per lb. f.o.r. Darwendale, and in addition has offered the above-mentioned bonuses to act as an encouragement to growers of Turkish tobacco to increase production. It is anticipated that the increased price will result in an expansion of the industry with consequent benefit to the Colony generally.

Soya Bean Seed.

Growers of the superior "Hernon" strains of soya beans which were issued by the Department at the beginning of the season, are requested to inform the Department what amount of seed they wish to offer for sale to farmers. It may then be possible to estimate the quantity of seed which will be available for sowing during next season.

Anti-Waste Measures.

In connection with a campaign for preventing waste on farms, the attention of readers is directed to the articles on compost making and vegetable growing which appear in this issue. A source of waste lies in the feeding of unbalanced rations to stock and poultry; valuable feed should not be given to dairy cows which do not respond well, and the advice of the technical officers of the Department should be followed. With regard to tobacco seed and maize, most growers carry out careful seed selection and treatment, but closer attention to the selection and grading of other seeds, especially legumes, is essential to better yields. Unsuitable seed may be used in rations or feed. Careless harvesting of potatoes results in leaving tubers in the ground which

produce a volunteer crop often of little value in land which could be put to better purpose. The cutting of haulms close to the ground, combined with thorough ridging, will help to reduce attack by tuber moth if the crop is to be left *in situ* during the dry season. Beans and other seeds susceptible to pests, such as weevils, can be stored in drums where they can be protected by a paper cover and fumigated, when necessary, with carbon bisulphide.

Before the main ploughing season starts, all worn parts and replacements of implements such as ploughs and harrows should be noted, and orders placed with dealers who will then be in a better position to estimate farmers' requirements for the season. Tractors and machinery ought to be overhauled in good time before they are needed. The tobacco growers can find time to put away in storage tobacco sticks, wire, twine, export hessian, cheese-cloth (after sterilising in boiling water), thermometers, hygrometers, etc., until next season. Flues in barns now used for other purposes than curing, should be protected from damage; a corrugated iron cover for boilers and immovable machinery will prevent rapid deterioration. Sacks should be collected, patched and placed in a safe place; vermin are said to be repelled if flowers of sulphur is liberally sprinkled over sacks piled up away from walls. Of course, practical farmers probably can think of many other ways in which waste can be prevented, and now is the time to act on this knowledge.

Humus and the Farmer.

Under this title, Mr. G. V. Jacks, deputy-director of the Imperial Bureau of Soil Science, Rothamsted, delivered a lecture to the Royal Society of Arts, in which he dealt with the origin of humus, its functions in the soil, and how far a shortage of humus-producing organic manures can be made good by other other means. Humus is derived from decaying plant and animal residues; it acts by promoting a granular structure in the soil, by supplying energy to micro-organisms, and by providing plant nutrients. In the natural state, vegetation supplies the kind of humus in which it best thrives, but cultivated crops do not supply such an optimum product, so that human intelligence and skill are needed to bring about that biological balance in the soil which is the essence of fertility. A grass cover is especially valuable for producing the granular soil structure that is needed by our basic crops, for these are also grasses, perennial for animals and annuals (cereals) for human consumption.

When a soil has lost its virginal fertility by long-continued arable husbandry, it is best rejuvenated by laying it down to grass for a shorter or longer period. When our ancestors first enclosed the open fields, they nearly always put them down to pasture. Later when clovers and roots were introduced, mixed farming became possible; animals could be kept throughout the winter and their manure conserved for the land. To-day much stress is laid on the necessity for rejuvenating our cultivated soils by ley farming or alternate husbandry. But the use of grass and plant and animal residues does not suffice in the absence of human skill and intelligence. These attributes became manifest

when drilling was first substituted for broadcasting seed, when the art of drainage was developed, and when artificial fertilisers were invented. Such fertilisers can provide all the nutrients plant require, though they cannot produce the granular soil structure effected by humus. Plant humus, on the other hand, will not make a soil fit for permanent Agriculture, for a human society makes far greater demands on the soil than does any natural plant community; nevertheless, every scrap of waste organic matter which the land produces should be returned to it.

RETIREMENT OF MR. R. W. JACK.

On 30th March, after thirty-three years' service, Mr. Rupert W. Jack, Chief Entomologist, went on leave pending retirement. At a representative gathering he was presented by the Minister of Agriculture and Lands with a canteen of cutlery and a cheque, on behalf of his colleagues in the Department. The Minister spoke in appreciation of Mr. Jack's work, particularly in regard to his outstanding achievements in tsetse fly control. It is pleasing to note that Mr. Jack will continue his scientific labours at the Tobacco Research Station, Trelawney, in studying the difficult problem of eradication of the root-knot nematôde which is a menace in most tôbacco growing areas.

Agricultural Cleanliness Now!

Now is one of the times for observing cleanliness The others occur throughout the year. A thorough cleaning of grading sheds, bulking rooms, and storage rooms for grain and other produce should be carried out as soon as these are emptied. Tobacco waste may be used in compost for manuring of crops other than tobacco next season. Seed-bed sites should be visited again and all tobacco plants and weeds removed and destroyed. On the lands tobacco stalks should be uprooted before the soil becomes harder. If maize is stooked for early ploughing, the stalks should be cut low so that the stumps and roots can be completely buried by the plough. In the vegetable garden all useless leaves, stumps, roots, weeds and unwanted plants should be removed as soon as their uselessness is established. "Stung" cucurbits, such as pumpkins and marrows, as well as affected fruit from the orchard, should be buried in a pit under two feet of well-packed soil, and not left lying about so that maggots in them can escape and complete their development in the soil. Or they can be broken and boiled and then used as feed. Strict and regular attention to these measures will help to prevent outbreaks during next season of pests of stored products, tobacco, maize, vegetables and fruit.

START NOW!—Cleanliness Aids Insect Control.

Book Notices and Reviews

Agriculture in Uganda: By the Staff of the Department of Agriculture, Uganda, edited by J. D. Tothill, D.Sc. Pp. XVI. + 551. Oxford University Press, 1940. 20s.

Both experts and farmers whose vision is not limited by political boundaries or the farm fence, will find in this reference work a mine of informatiin on Uganda agriculture. The volume is the result of a co-operative effort by 21 authors and 32 collaborators of the Department of Agriculture; it is well illustrated by 5 maps and charts, 9 text-figures and 30 good photographs.

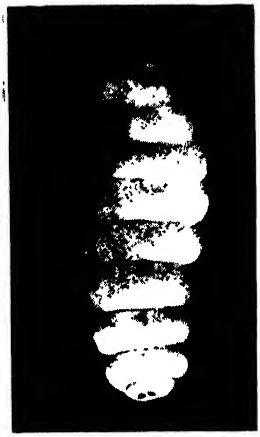
The wide scope of the volume may be indicated as follows:—

I. Introduction by the Editor.
II. General agricultural topography, vegetation climate, native agriculture, soils, soil erosion problems, manures, compost
III. Government Experiment Stations and farms (*a section we would like to see extended in future editions*).
IV.-VII Native food crops which form the bulk of the volume bananas, roots, cereals, ground nuts, legumes, etc
VIII. Cotton and cotton breeding.
IX. & X. Coffee
XI Sugar.
XII. Tobacco.
XIII. Plantation crops (cocoa, rubber, tea)
XIV. Oil yielding plants, essential oil plants
XV Spices and condiments.
XVI. Fibres (kapok, sisal, paper-making materials)
XVII. Cover crops and shade trees, windbreaks.
XVIII. Fruits, pawpaws, vegetables (*much of which we regret to note are imported from Kenya*).
XIX. Grasses and grazing, silage, weeds.
XX. Bees and bee-keeping.
XXI. Marketing.
XXII. Agricultural education and extension work

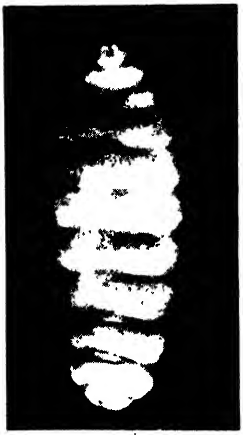
Insect pests and diseases have been dealt with in commendable detail. We notice a record of a fly parasite of the Migratory Locust as *Sericophoromyia quadrata*, Wied. (p. 520); the latter in Southern Rhodesia and South Africa attacks moth caterpillars and the Uganda record should be confirmed. We congratulate the Department warmly on completing such a full survey of agriculture, and we hope that surveys with similar scope will be published by other Agricultural Departments in Africa.

A.C.

8



9



10

11

PLATE 2 (Vertical lines indicate life size).

Fig. 8 Skin Maggot Fly (highly magnified).

Fig 9 Mature maggot (seen from above).

Fig. 10. Mature maggot (seen from below).

Fig. 11. Rat heavily infested with maggots.

Note.—The hair has been removed to show tumours.

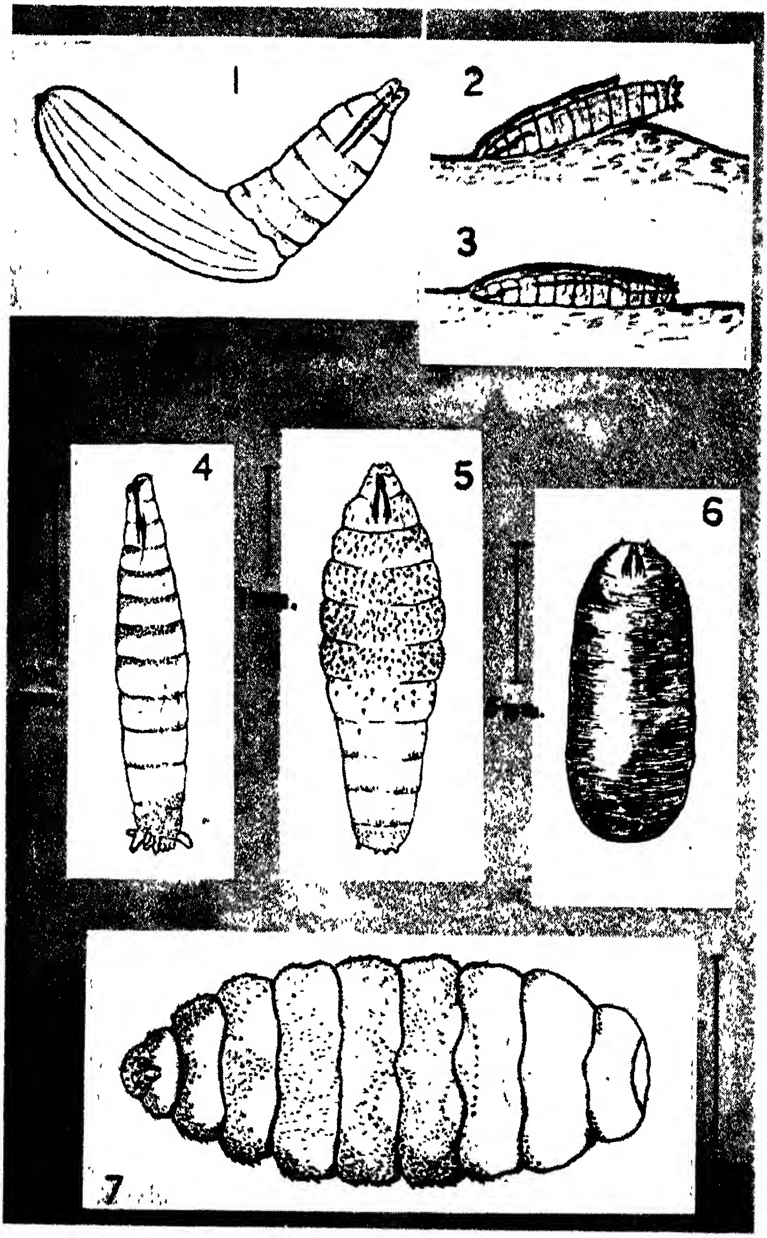


PLATE 1. (All figures highly magnified)

Fig 1 Maggot hatching from egg.
Figs. 2 and 3. Maggot penetrating skin.
Fig 4. Immature maggot (soon after hatching).
Fig. 5. Immature maggot (after first moult).
Fig. 6 Pupa (or *puparium*) (life size 4/10th inch).
Fig 7 Mature maggot (life size ½ inch)

The Skin Maggot Fly.*

LIFE HISTORY AND PREVENTIVE MEASURES.

By Alexander Cuthbertson, F.R.E.S., Entomologist.

The following brief account of the Skin Maggot Fly, its life history and habits, with suggestions for preventing attack, has been written in response to numerous requests by the public.

LIFE HISTORY AND HABITS.

The Skin Maggot Fly is yellowish in colour with two dark stripes on the greyish thorax and dark markings (Pl. 2 fig. 8) on the hind body; the wings are transparent and plain, sometimes a little clouded; the legs are reddish yellow. It is a thick-set fly about the size of a blue bottle or blow-fly.

The fly is seldom seen. It rests in dark places in houses, verandahs and in native quarters. When disturbed it flies rapidly and makes a buzzing noise; it is usually quite easily caught by means of a butterfly net. It is active from December to March, i.e., during the rainy season. In appearance it closely resembles certain large brownish bristly flies called *Bengalia*, which sometimes occur in houses, and are often mistaken for the Skin Maggot Fly. *Bengalia* flies waylay ants and seize the insect food or any grubs or pupae carried by them. The food of Skin Maggot flies consists of juices exuding from decaying fruits and decomposing animal matter.

Life History.—There are four stages in the life cycle of the fly, viz., egg, maggot, pupa (or resting stage) and adult. Much of the following information has been taken from an important paper by Blacklock and Thompson (1923).

Egg (Pl. 1, fig. 1).—Usually the fly lays its eggs singly just under the surface of sandy soil which has been contaminated with urine and excreta; sometimes the eggs may be deposited in clothing out of doors, but never directly on the skin of animals. The eggs are very small (less than 1/16th inch in length), whitish in colour and somewhat banana-shaped. They are not easily found in the soil owing to the minute particles of sand which adhere to them after they are deposited. Several hundreds of eggs are placed here and there in suitable shady places by a single fly, or they might be all laid in a small area. A fly may lay as many as 500 eggs during her life time. The eggs hatch in two or three days.

Maggots.—The newly hatched maggots (Pl. 1, fig. 4) are only slightly larger than the eggs, and are very active, crawling over

***Cordylobia anthropophaga*, E. Blanch. (Family *Calliphoridae*, Order *Diptera*.)

the ground in search of a host. They can live one or two weeks without food. When a suitable host animal has been found, e.g., a puppy, or rat, or guinea pig (Pl. 1, figs. 2 and 3) they crawl upon it and commence to bore their way under the skin. They feed on the living tissue, producing at first a small red pimple or papule which causes itching. Later a large "boil" or tumour develops, often producing much discomfort and pain. At the time of penetrating the skin the maggot is in the first stage (Pl. 1, fig. 4). After feeding for two or three days it moults, becoming larger (⅛th inch) and somewhat club-shaped in appearance (Pl. 1, fig. 5). On the fifth or sixth day it moults again, and is fully-fed on the eighth or nineth day (Pl. 2, figs. 9 and 10) in humans, but one or two days earlier in rats. When mature the maggots (Pl. 1, fig. 7, Pl. 2, figs. 9 and 10), which are then nearly half an inch long, leave the body of the animal and drop to the ground, where they transform to the pupal stage, corresponding to the chrysalis stage of butterflies (Pl. 1, fig. 6) usually near the surface of the soil.

Pupa.—The outer skin of the maggot contracts and hardens, afterwards becoming dark chocolate brown in colour and somewhat barrel-shaped (Pl. 1, fig. 6); it is then called a *puparium* (about 4/10th inch in length). The insect develops inside this puparium, and emerges from the soil in about two weeks as an adult fly.

Host Animals.—Amongst domestic animals those most frequently infested are puppies, dogs, and pets such as guinea pigs. Babies and young children appear to be more frequently infested than older children and adults. In West Africa, rats are known to act as reservoirs for the breeding of the fly and thus constitute a danger, apart from that of spreading plague, to the community (Pl. 2, fig. 11).

Treatment of Tumours.—When older children and adults are attacked the maggots may be allowed to develop to maturity, that is, for about a week from the first signs of attack. The matured maggots can then usually be removed without much pain by squeezing on opposite sides of the tumour or boil with the thumbs. In the case of infants and young children which are heavily infested, it is wise to call in a doctor to remove the maggots while they are still very small. Dressings such as paraffin oil, etc., are not advised.

PREVENTIVE MEASURES.

The following preventive measures for avoiding attack are suggested:—

(1) Prevent access of the fly to children's perambulators and cots by always using a mosquito net cover during the wet season. When not in use, keep the perambulator indoors, and wash it out carefully with disinfectant and soapy water from time to time. Blankets and infants' clothing should be thoroughly washed to remove traces of urine or perspiration which may attract the fly.

(2) Do not allow babies or young children to crawl or play in places which might be contaminated with urine or faecal matter. If puppies or pets are handled by children, the former should be examined for maggots regularly. Children should be kept away from native quarters and the immediate vicinity.

(3) All clothing should be thoroughly washed and hung on a line, but never spread on grass to bleach or dry. Clothes which have fallen from the line should be re-washed. Infants' clothing is best dried indoors. Do not leave bundles of washing out of doors, or on verandahs. Ironing should be carried out carefully with a very hot iron. Immediately after being ironed and dried indoors, infants' clothing should be put away in a drawer or closed cupboard.

(4) Maggots removed from dogs or pets should be destroyed. When merely thrown on the ground, they will enter the soil and might, if mature, complete their development, and thus lead to further trouble. Pens containing guinea pigs or other pets, should be regularly cleaned and the soiled bedding removed. It is a good plan to move the site of the pens once or twice during the wet season, and to collect contaminated soil and straw, which then can be placed in the compost or manure heap.

The writer is investigating the subject of the Skin Maggot Fly in collaboration with the Medical Department. He will welcome information bearing on the following points from people who have experience of the Maggot Fly:—

(1) Date; facts or theories regarding causes or origins of infestation; presence or absence of dogs or pets;

(2) Age of patient; site of infestation; number of maggots removed; lesions more numerous on covered parts of body?;

(3) In cases of the same person being attacked more than once, was the same area of skin infested? Elsewhere in Africa it has been noted that laboratory animals (dogs, monkeys and rats) which had been once infested, acquired local immunity affecting the areas of skin previously invaded.

ACKNOWLEDGEMENTS.

The writer is indebted to Dr. G. R. Ross, Director of the Pasteur Institute, Salisbury, and to many medical officers for assistance received in the course of preliminary investigations.

All the above illustrations have been taken from a paper by Blacklock and Thompson (1923) except Figs. 9 and 10, which appeared in Patton and Evans' text-book (1929); the figures have been slightly modified.

REFERENCES TO LITERATURE.

Blacklock and Thompson (1923): *Ann. Trop. Med. & Parasit.* Vol. 17, pp. 443-501, 4 Pls., 4 Figs.

Patton and Evans (1929): Insects, Ticks, Mites . . . of Medical and Veterinary Importance. Pt. I., Medical. Liverpool School of Tropical Medicine.

Conserving Soil in the Native Reserves.

By DOUGLAS AYLEN, Technical Assistant for Soil Conservation.

CONDITIONS IN THE RESERVES.

General conditions and agricultural practices in the Reserves differ in many respects from those prevailing on farms, and for that reason problems and advantages are both encountered which do not occur on the European farms.

In each Reserve there are a number of villages each with a roughly defined communal block of land. At least, that is how it used to be before our occupation. The community of a village, or sub-division of a tribe, held a block of land by force of arms. As a rule the tribes are located now more or less where they were before the occupation, but some expansion and retraction, and migration have taken place. However, they chose the more easily worked (and more erodible sandy soil), and districts in which permanent streams rose or through which permanent rivers flowed. Such country is naturally more hilly than is usually the case in European areas.*

The areas designated as Reserves were ample for the native population and stock at the time of demarcation, but the type of agriculture and the crops have changed since then. In a little over thirty years the population tripled and stock increased thirty-fold; to-day some 100,000 ploughs are in use whereas forty years ago only primitive hoes were used. To-day a family may plough and plant as much as twenty acres. However, it would appear that the present areas can be made adequate by the adoption of conservation and better methods of grazing and cultivation.

Nevertheless it must be admitted that some areas have suffered extreme depletion of plant cover and serious erosion through gross overstocking, and to such an extent that drastic reduction in numbers of stock is an urgent necessity, whilst in a few cases total closure of the area for a few years is required if these areas are not to erode beyond all hope of repair and to become deserts.

We all know what little value the native places on property and articles of which he is not the individual possessor, and how he will cut down trees in order to gather fruit or caterpillars. Remember also that he has the tradition of the old hoe-patch days of shifting agriculture.

There was little appreciable erosion when the native scratched out about an acre of garden amongst trees and scrub, and then abandoned the garden after a year or two leaving it to recover

This article has been prepared in collaboration with Mr. K. J. Mackenzie, Soil Conservation Officer for Native Areas, and Mr. E. D. Alvord, Agriculturist for Natives.

for many years before the land was again used. Revertion to natural cover is rapid under these conditions and fertility is soon restored.

To-day he ploughs ten times the amount of land he used to hoe, clears it, and uses it for many years. No longer are the patches of land isolated by veld but very often they adjoin to form a continuous block of many acres, and in some cases several hundred acres.

With no traditional respect for the soil, and until recently no experience of the effect of erosion, and no sense of individual ownership of the land, and little or no opportunity to see the advantages of better methods, the native could not be expected to understand the reason or necessity for soil conservation measures, and cultural practices which retard erosion. Yet considering the limited nature of his opportunity to come in contact with improved methods he is taking to conservation more readily than would be thought possible.

When confronted with the facts the native accepts them, but he has a more valid excuse of ignorance for his wasteful methods than the European farmer.

THE SCOPE OF THE WORK.

The actual work in the Reserves can be sub-divided into stages. The actual stages are seldom adopted in the order given below, but as this article deals with soil conservation, I have given the order from that point of view. Later each stage will be reviewed in turn.

(1) *Centralisation.*—The Reserve is surveyed and divided into grazing and arable lands, selecting for each purpose the land best suited to that purpose and utilising as far as possible the natural features of the country (i.e., hills and rivers) to demarcate the divisions. Village sites are also selected.

(2) *Planning and Layout* of the soil conservation works. The roads are also altered to conform with soil conservation principles if this work can be done at a small cost.

(3) *Construction* of the soil conservation works.

(4) *Allocation* of plots within the soil conservation works to individual natives, and the gradual removal of huts to the new village site.

(5) *Demonstration* of better methods of agriculture, and in certain cases the planting of trees is demonstrated.

(6) *Improved water supplies.*

(7) *Maintenance* and supervision of the above items.

DESCRIPTION OF THE INDIVIDUAL STAGES, THEIR ADVANTAGES AND ADMINISTRATION.

CENTRALISATION.—Uncontrolled grazing and cultivation result in some cases in innumerable scattered plots being made throughout the Reserve, in others an excessive area is ploughed up on a critical slope, with consequent serious erosion.

The scattered nature of the holdings involves constant herding and driving of grazing stock if they are not to damage the crops. This constant driving is a cause of much gully erosion in Reserves, because under such conditions the stock destroy by tramping far more grass than they eat, moreover the innumerable tracks are a frequent source of gully erosion.

With centralisation the land least subject to erosion is chosen for the arable area. As the division between arable and grazing areas is usually some natural feature, or a village or a road, herding and driving of cattle is greatly reduced because they can be more easily kept away from the crops. The mere fact that after centralisation stock are able to roam more freely with consequently a great reduction in tramping, has in many cases resulted in a very great improvement in the grazing and the healing of all but the deep narrow and rapidly eroding types of gullies.

A well chosen village site also means a reduction in the passage of cattle and of sledges up and down the slope when hauling manure and crops to and from the land and water from the source of supply to the village.

If possible the crest of a long ridge is chosen for the village site so that rain water may be easily drained away at frequent intervals, if that does not occur naturally. Most new villages consist of huts on each side of a road and are built on "residential stands" 60 x 80 yards, with a cross road leading from arable to grazing areas between each pair of plots.

In some cases the natives have chosen to make the road straight and have placed the huts as in a military encampment. Such an arrangement does not best serve soil conservation nor the landscape. In some other cases the hut sites have been indiscriminately chosen by the natives with a result that they are cramped together in places and even encroach on the road strip. Erosion is bound to occur in such cases and control is difficult unless some of the huts are moved. On the whole, however, villages are pleasant to the eye and advantage has been taken of the choice of site so that erosion is unlikely to become a problem. Sometimes owing to the nature of the terrain it is impossible to choose a good site, but in every case the best use is made of the topographical features of the country.

Sometimes in hilly and rocky country the village can only be located just below the division between rocks and soil on the slope of the hill-side. Such sites can be easily and satisfactorily protected if the protecting drains are made in advance. A very necessary procedure when, as is usually the case, the arable lands adjoin the village. Naturally the terrain will always preclude the adoption of a standard plan, and whilst advantages can be utilised, there are always difficulties which to a varying degree prevent the attainment of perfection, but nevertheless centralisation has worked well everywhere and often by itself overcome or circumvented many serious erosion problems.

Planning the Soil Conservation Works.—This stage may proceed but usually follows centralisation, as one without the other (or without the subsequent allocation of the land) cannot achieve satisfactory results. Unfortunately conservation lags

behind centralisation, even though some 2,500 miles of contour-ridges and drains are now set out each year. It would seem that both these items should be planned and executed at the same time, and that allocation should also follow in close sequence. However, the first and last items come under the authority of the Native Department whilst the others are carried out by the Soil Conservation Officer. A further complication arises later because after one year it becomes the responsibility of the Native Commissioner to ensure that the conservation works are maintained in good order. The difficulties will be dealt with more fully under "*Maintenance.*"

It may be stated now that there is one loophole in centralisation which allows a serious conservation problem to arise, *viz.*, that each family is allowed half an acre of winter garden where ever it likes. This winter garden is, of course, made in a vlei, and the deep drains and high beds adopted for this form of cultivation often rapidly turn to gullies. These hollows in which the winter gardens are made, are also usually of vital importance as a channel for the disposal of the outflow from drains and ridges. The gardens are presumed to be fenced off with wire, but actually in most cases brushwood, or even solid pole fencing, is used. The old Water Act prohibited cultivation in or close to stream beds and water courses and the draining of vleis, but this provision was overlooked on farms and Reserves alike

The arable area for a village having been chosen, the Soil Conservation Officer examines it and decides on a practical scheme which will utilise natural features as far as possible, but which requires a minimum expenditure on storm drains, outflow water channels, gully control and roads—all expensive items which greatly add to the cost of the protection of the land. He may find it necessary to make some rearrangement of the areas demarcated by centralisation.

It has been found that contour-ridges over 250 yards long are more liable to breakages than shorter ones, and also that regulations which prohibit passage over the contour-ridges are apt to be ignored where they are long, since natives are more tempted to take short cuts over them. For this reason, an endeavour is made not to exceed this length: consequently if the ridges discharge in both directions a non-erosive outflow water channel must be found or made at intervals of 400 to 500 yards.

In order to discourage crossing of the ridges roads are made down the slope half way between the outflow channels. This means that every 200 yards or so along the slope there is alternatively a road with contour-ridges flowing away from it, and a channel into which the contour-ridges discharge. There is no erosion on these downhill roads, as they are crowned and provided with side drains which are intercepted by the contour-ridges.

Incidentally, whilst on the subject of roads, it may be men tioned that one or other of the following alternative principles are adopted as far as possible in order to overcome erosion:—(1) Location of the road on the crest of the water-shed. (2) Location of the road immediately below a storm drain on gradient. (3) Avoidance of traversing a slope; instead the road is taken straight down where the fall is least, and drained either into contour-ridges or into drains, at close intervals, which discharge into the veld.

Having decided on the roads and channels the top storm drains are first marked out and then the ridges follow below. A gradient of 1 in 150 is used for the drains and one of 1 in 400 for the ridges. A vertical drop of seven feet is given between the ridges, except on gentle slopes, when the distance between ridges is kept to 75 yards.

The actual pegging of the lines is carried out by 4 or 5 trained natives using small engineers' levels and each sighting on a target on a separate staff. The staff consists of a long plank, marked off in feet and inches with a notch corresponding to each mark for a stud on the target.

When moving from a peg to the next place the target is moved to the next notch. A check is kept by counting the number of pegs and the number of notches, both outwards and on the return journey. By varying the number of paces between pegs varying gradients can be set out, but in practice only the two given above are used.

The Soil Conservation Officer using a standard engineer's level can from time to time sight on a staff in the ordinary way, and check up on the accuracy of the levels and distances.

The roads and outflow channels are marked with flags before pegging commences, but often are further marked by running a lorry up or down them, this also gives the Soil Conservation Officer another opportunity to inspect the proposed sites of these two items.

Frequently the site of the proposed grassed outflow channel is ploughed land, but usually it has some grass and weeds growing and soon becomes well established with vegetation before appreciable run-off from the contour-ridges occurs, as in the sand veld all of the first rains penetrate.

If the drain strip or outflow channel site has furrows, footpaths or runnels in it these are blocked at intervals and a spadeful of earth and couch grass thrown in just above the block.

Some hundreds of these grassed water-ways are in use, and even minor and easily controlled erosion has occurred in only a very few.

A similar system has long been advocated for farms where lands are large, but only a few grassed water-ways have been made, though in some cases farmers have planted trees in the proposed water-way two or three years before it would be put into use, thus providing a water-way, wind-break and source of timber supply all in one.

The Soil Conservation Officer can be envied this system of layout as he is able to choose those lands which are most suitable for arable purposes as regards degree of slope and location and is never called on to lay out systems which owing to their undue length or unfavourable location are doomed to failure.

Some may have noted that the spacing of ridges is about 50 per cent. wider than recommended for farms, this wider spacing is permissable owing to the shorter lengths and the difference between the cultural methods.

1 Crops amongst the trees but on a larger scale than was practiced prior to the introduction of ploughs

2 Worked out land, now closed to cultivation by "Centralisation."

3. Erosion of cattle paths. A demonstration plantation of Eucalypts in the background.

4. Erosion in the vicinity of a dip-tank subsequent to denudation caused by the concentration of stock.

5. A deep narrow gully. A common type in the sand veld. The bank of a diversion drain recently constructed round the head of the gully may be seen across the middle distance.

6. The commencement of lateral erosion in a large gully. The adjacent land was seriously eroded, and has been closed against cultivation.

7. An eroding "thoroughfare." To-day, two years later, this section has become a series of gullies and the road once again has been diverted.

8. A small stream just below a Reserve. Two years ago this stretch of sand was a permanent pool.

9. Solid pole fences round winter gardens in a natural water channel

10. *Foreground*: Typical native crops. *Background*: A demonstration plot of maize in front of which is a demonstrator giving a talk on agriculture.

11 The tractor unit building contour ridges (N B --An illustration of hand made contour ridges appeared in the Journal for August, 1941)

12. A nine foot storm drain Standard drains are usually 9 or 12 feet wide, though occasionally 15 feet, and even 18 feet wide drains are required.

13 Smoothing out a gully which was six to eight feet deep Grass will be planted when this operation has been completed

14 Satisfactory control of a large gully It is still 14 feet deep in the foreground. Fig No. 18 of the "Erosion and Malaria Control" Bulletin--April, 1941 was obtained at the identical place when control measures were being undertaken eleven months previously

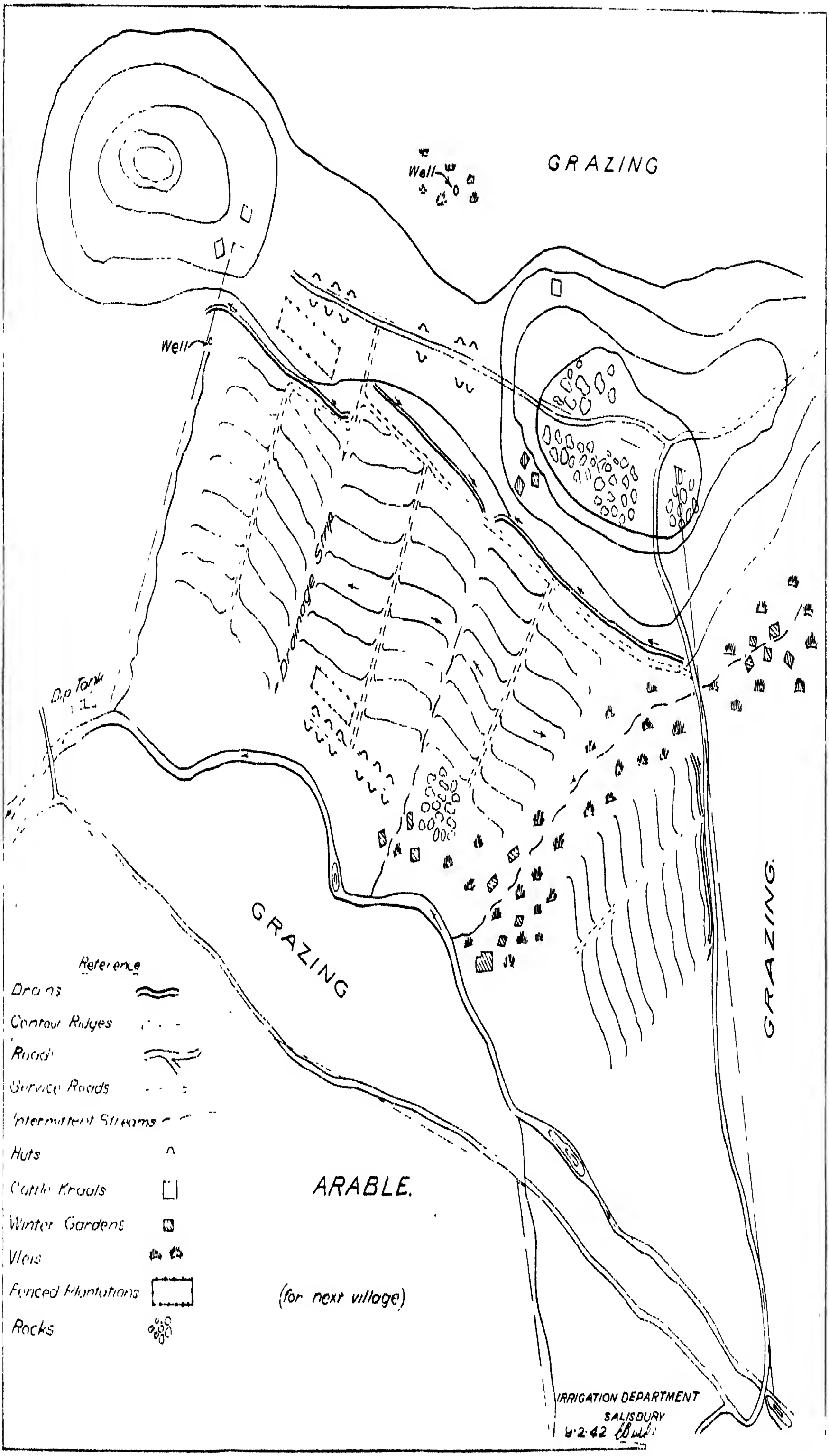


Diagram of a typical lay-out for a "centralised" village with contour-ridged lands.

CONSTRUCTION OF THE SOIL CONSERVATION WORKS.—The actual construction of the contour-ridges was described in an article in this Journal for August, 1941, and it is hoped that it will be reprinted in a condensed form for distribution to all farmers who are making contour-ridges by hand work. However, it would be as well to discuss briefly grassed water-ways. These, whether natural hollows or artificial "drainage-strips," are marked by a bank similar to a contour-ridge down each side. (Incidentally the soil for the banks is all obtained from the outside of the drainage-strip in order to preserve an unbroken surface in the channel.) The object of the bank is two-fold, (1) it confines the water to the strip, and (2) it prevents encroachment by the native cultivators.

As soon as possible after pegging, the lines are marked by at least two plough furrows. The contour-ridges are made of the narrow type for the sake of economy (though much wider than those built by most tobacco growers) and are gradually widened by ploughing against them. After a few years the plough can be entered along the crest of the bank, when by ploughing a gathering furrow commencing on the bank, it is heightened and widened. This practice is all that is required to maintain a contour-ridge; the size is increased to a very substantial bank after 5 or 6 annual ploughings.

ALLOCATION OF PLOTS TO INDIVIDUALS. As soon as the ridges have been constructed plots should be allocated to the natives, but sometimes centralisation will already have moved them to the area, and in that case one can only hope that pegs and furrows will not be obliterated during the period between pegging and construction. This period may be almost a year as the Soil Conservation Officer and his gang on visiting a Reserve try to peg sufficient work for the construction gang to keep it occupied for the year, and of course little pegging can be done in the Reserve during the summer, whilst the construction gang work all through the year.

In some cases centralisation may follow the construction of the conservation works, but once the works are made no native in the area is supposed to cultivate unprotected land.

Owing to pressure of work the Agriculturist for Natives is often unable to allocate the individual plots until some time later.

One of the Soil Conservation Officer's biggest difficulties is that he is seldom able to obtain in advance an estimate of the crop area required by any village, consequently to be on the safe side too much is often pegged. Maintenance of the surplus ridges by the natives is bound to be neglected and thus a new erosion problem may be created by breakages in them.

It has usually been found that once the arable area has been contour-ridged there is a sufficiency of land even in apparently previously seriously overcrowded Reserves. Some Reserves are, of course, so badly eroded and overstocked that a redistribution of population is required, but Centralisation, Conservation and Allocation appear sufficient measures in all but the most extreme cases.

DEMONSTRATIONS.—There are about 90 Agricultural Demonstrators and 30 Community Demonstrators working under the super-

vision of the Agriculturist for Natives. They demonstrate crop rotations, etc., on a number of plots, supervise improved practices on the plots of a number of "Co-operators," or direct various community improving enterprises.

The crops grown on these plots are very markedly superior to the average, and the native is beginning to realise that smaller areas better cultivated are more profitable than large areas cultivated in the old style.

There are also a number of tree planting demonstrations, but this work is not as far advanced as the crop demonstrations.

Last year a series of contour-ridge demonstration plots were made and this work will be spread until small soil conservation demonstration plots are well distributed over all the Reserves.

Soil conservation is not forced on the natives, but is only adopted where the majority vote for it, when it becomes compulsory for all. Tactful and careful explanation of the benefits of soil conservation by the Native Commissioners and Chiefs does much to educate the natives, but when demonstrations are added as a proof, it is believed that the positive conversion will be more readily attained, thus facilitating the supervision of maintenance.

Water Supplies.—Throughout Rhodesia erosion and depletion of the natural cover have brought about reduction in varying degrees of severity of the natural water supplies such as streams, springs and vleis. In a few cases boreholes have only lowered the water table or, for other reasons, have eventually proved unsatisfactory. Dams can soon be ruined if the catchment area is suffering from serious erosion, whilst weirs across a sandy river soon become filled with silt. Many of the natural pools in the rivers have also become filled with sand. Soil conservation, by preventing erosion and causing more water to penetrate, is thus doubly beneficial to natural water supplies, and is essential if dams are to be permanent, a point worthy of consideration by the many farmers who are served by streams which rise in a Reserve.

In order to promote better distribution of stock where there are large areas devoid of surface water in the dry season, water supplies are being developed. Natural supplies also have been improved by the prevention of erosion. The farmer and rancher will realise how big an undertaking is this combined programme of soil and water conservation.

Supervision and Maintenance.—The supervision of soil conservation gangs is carried out by an overseer (boss-boy), and a travelling native supervisor who visits a number of gangs in turn. The Soil Conservation Officer or his assistant endeavours to visit each gang several times a year, but the gangs are widely distributed amongst the Reserves and often some way off from the nearest passable track, perhaps even isolated during the summer.

After the soil conservation works have passed through a season they come under the jurisdiction of the local Native Commissioner. The overseer, demonstrators and Native Department messengers are instructed to report to him any infringement of the regulations relating to centralisation, soil conservation, allocation of plots and methods of cultivation.

Incidentally, ploughing not on the contour is forbidden, likewise the grazing of animals in the arable areas unless all crops have been removed, as well as passage over the contour-ridges by animals or implements. The making of new paths or roads or the use of tracks other than the demarcated ones is also forbidden. Each native is also responsible for the maintenance of the drain or contour-ridge along the upper boundary of his plot. There is no need to explain that supervision from a distance is difficult or that the sub-division of conservation into different branches, or to different authorities, has its weaknesses, but in spite of this and other difficulties, something has been achieved which would be an eye-opener to most farmers, and the only pity is that it is not on a larger scale. Two thousand or more miles of protective works each year may appear to be a big effort, but it is very far from an adequate amount when the size of the Reserves and the extent of erosion are taken into account

Gully Control.—This problem is just as acute in the Reserves as on the farms. It would be of great interest to carry out extensive gully control experiments on farms, but the unwillingness of farmers to spend money on a doubtful proposition and the lack of facilities and funds has so far prevented the undertaking of experiments on any but a very limited scale. However, last year some very useful work was done in Chindamora Reserve. It was handicapped in many small ways, mainly by inadequate technical supervision, but some good results were obtained and some very useful knowledge gained.

In the near future it is intended to engage and train several small gangs for gully control work in the Reserves.

Roads for Internal Traffic.—These roads on the whole are in a deplorable state, except in a few instances where Native Commissioners with experience have set them out. Even then it would appear that advantage of topography has often not been fully utilised and sometimes sacrificed in order to obtain straightness.

Most of the roads originated as footpaths or sledge tracks made by the natives; these paths wandered hither and thither without thought of erosion, and with further use became "roads."

These roads are used by Native Commissioners, "dip" supervisors, doctors on their way to clinics, Government officials, such as agriculturists, centralisation surveyors, soil conservation officers, traders, miners, missionaries, as well as the native demonstrators, overseers, messengers, constables, teachers, etc., and, of course, the natives themselves for passage and transport. Many are frequently impassable by car, and often one may see half a dozen or more abandoned gullied tracks alongside the existing road. Yet if all those who are working for the welfare of the native are to do their work efficiently it is essential that all parts of the Reserves should be accessible. Thus the roads present a serious difficulty to both erosion control and administration.

COMPARISON WITH EUROPEAN AREAS.

In some respects, notably planning and constructing, the work in the Reserves is of a higher standard than that done on

the farms. Few farmers are willing to replan their farms so that each portion of the farm is used for the purpose for which it is best suited, and as a whole on a basis which fits in with soil conservation, nor has the majority yet learnt that inadequate size or excessive length of drains and ridges invites disaster, nor that steep drains give trouble and do much damage. In a few cases the work on farms is of a very much higher standard than in the Reserves, but this is the exception rather than the rule, yet there seems to be no reason, especially with the closer supervision possible on farms, why this should not be generally so.

The work in the Reserves possesses so many interesting features that it is considered that farmers would profit by a visit to a soil conservation area. Native Commissioners, if approached by a sufficient number of farmers, would without doubt be pleased to conduct a tour round soil conservation works if there are any to be found within a reasonable distance. Such a visit, besides giving the opportunity of inspecting work undertaken under strange conditions, would add convincing proof of the often-repeated assertion that neglected erosion is directly harmful to all land within the confiines of the water-shed, and thus help to bring about a more general realisation that soil conservation should be more thoroughly planned and on a wider scope, not only as regards the area of operations but also as regards the measures which should be adopted.

A COMPREHENSIVE PLAN.

This year it is intended to complete the protection of a large block of land in one fairly well populated Reserve, where during the last few years 7,000 acres have already been contour-ridged, by undertaking the work on the remaining 23,000 acres of arable land within this block.

The works will be set out for the natives, and under the powers conferred by the Natural Resources Act they will be ordered to construct them. They will be lent one hundred "Evans-type" land levellers fashioned from old railway steel sleepers, and a supply of discarded shovels.

Such an order would only be possible where the natives have reacted favourably towards soil conservation, and in this case this attitude has been brought about by the work already done, and the interest taken by the Native Commissioner of this district. Next year no native will be allowed to cultivate unprotected land within this area.

In order to encourage adequate construction and ensure completion of the works a small bonus (based on yardage) will be paid to the natives of each village or community when all the lands belonging to that group are fully protected by completed works built up to the full size. Other conservation measures will, of course, also be applied.

If the scheme is a success the rest of the arable lands, a further 20,000 acres, will be protected next year.

Kraal Compost.

By S. D. TIMSON, M.C., Assistant Agriculturist.

[*The general Bulletin on Compost is again out of print, and this article has been written, in response to requests. The opportunity has been taken to include new matter concerning the measurement of the soil and wood ashes required, and the time required to keep cattle on the wastes.*]

This method of making compost is the simplest, and, as far as six years experience shows, the best for local farming conditions. In particular it is to be recommended because it conserves the most important liquid portion of the manure without the aid of expensive drains, sumps and pumps.

It consists simply of placing the raw materials (crop wastes, grass, etc.), under the feet of stock for a time, adding a little soil, and wood ashes or agricultural lime, and then building these materials into heaps of suitable size. The heaps are then turned over several times by forks.

RAW MATERIALS REQUIRED.

1. **Wastes.**—Any waste materials such as wheat and maize threshing wastes (husks, stalks and cores), sunflower stalks, cotton stalks, leaves of trees of all kinds (except coniferous trees), green or dry veld grass, and the top growth of crops grown for the purpose, such as Napier fodder, or a mixture of sunnhemp and munga. A small proportion of sawdust, wood shavings and leaves of coniferous trees can be included.

2. **Soil.**—Soil soaked in urine obtained from kraals, cattle standings, etc., is best. Next best is antheap soil. If these two are not available use ordinary soil, including that which collects as a result of erosion of the arable land. Heavy soil is better than light sandy soil; but use the soil from the nearest source as far as possible.

3. **Wood Ashes or Agricultural Lime.**—Wood ashes are preferable to lime, because they contain useful quantities of potash and phosphates. If oil drums or other receptables are placed in the native compounds large quantities can be obtained from this source.

METHOD OF MAKING COMPOST.

Make a cattle kraal where convenient, and on a firm smooth surface. If veld grass is the chief raw material, make the kraal, or kraals, on the edge of the area to be cut. Make other kraals beside the maize shelling dumps or wheat threshing sites. Put your kraals, in fact, near the source of the chief raw materials, so as to avoid slow and expensive carting, by using hay-sweeps and hay-drags to move the wastes up to the kraal.

Size of Kraal.—Don't make the kraals too big, otherwise the wastes will not be properly broken up by the feet of the cattle. Ten square yards per full grown beast is the maximum space necessary, and 6 square yards per beast is ample, unless the cattle are wild, of course.

Filling the Kraal.—To start with place the wastes in the kraal to a depth of about 1 to 1½ feet in order to soak up the liquid manure. Then, every few days, as the cattle tramp down and soil the bedding (wastes) spread more wastes evenly in the kraal to a depth of a few inches, and repeat the process until the kraal is filled to a depth of 1½ feet with well trampled and soiled bedding. Then clean out the kraals and start again. Four natives can clean out a kraal 250 square yards in area in one day. The soiled wastes are made up into heaps as detailed below. Whenever possible use a mixture of two or more different kinds of wastes.

Adding Soil and Wood Ashes or Lime.—From time to time the necessary soil and wood ashes are sprinkled evenly over the bedding in the kraal. The best time to do this is just before putting in more bedding. In this way the soil and ashes become well mixed with the bedding, as is necessary. The quantities of these materials required is based on 50 square yards of area of the kraal. For every 50 square yards the following total amounts should be added, a *portion at a time*.

Materials	Rates.
Soil	6 to 12 bags,
	or 1 to 2 Scotch carts full.*
Wood ashes	1 to 2 bags
or	or
Lime (agricultural)	⅓ to ⅔rds bag.

*A Scotch cart is taken as containing one cubic yard. Since these carts vary somewhat in size this should be checked.

In order to ensure even mixing of the soil and ashes with the wastes, the latter should be spread in the kraal in at least 4 or 5 portions of the total quantities given in the table above.

If the waste materials are soft, such as grass and wheat straw, the half rate of soil only is needed. If they are hard and woody, such as mature sunnhemp or whole maize stalks, or cotton stalks, use the full rate of soil. If the soil is a sandy type use the half rates of soil, and increase the quantity of wood ashes or lime.

Period required to keep Cattle in Kraal.—The following simple formula will serve to guide the farmer in deciding how long to keep the cattle in the kraal. The constant basis of the formula is 18 inches depth of trampled and soiled wastes in the kraal when the kraal is cleaned out. If the depth of wastes is greater or less than this the cattle must be kept in a longer or shorter time in proportion to the increase or decrease in depth. On present experience, however, it is thought that it will save labour in cleaning out the kraals if the wastes are not allowed to accumulate to a greater depth than 18 inches, since it is then possible to do the work with forks only, and the work is easy. If a greater depth is accumulated it may be necessary to employ picks or mattocks in cleaning out the kraal, and the work becomes harder and more expensive.

The Formula.

$$\frac{\text{Area of kraal (sq. yds.)}}{\text{Number of cattle.}} = \text{Number of days to keep cattle in kraal.}$$

In other words, divide the area of the kraal in square yards by the number of cattle, and the resulting figure obtained is the number of days (of 24 hours each) it is necessary to keep the cattle in kraal. One night can be reckoned as half a day for this purpose. On this basis the farmer can be sure that the wastes receive sufficient dung and liquid manure to ensure their proper rotting. If the farmer has more wastes than his cattle can deal with on this basis, he can reduce the number of days gradually until he finds the lowest limit for the materials he is using.

Making the Heaps and Turning Them.—After cleaning out the kraal the wastes are made up into heaps 3 yards wide (4 yards in dry districts), by 4 feet high, by any length which is convenient. Remember to arrange your heaps so that the wagon can get to them easily for carting the ripe compost. After rain has penetrated the top of the heaps to a depth of 6 to 9 inches, they should be turned with the fork, working from one end or one side, and built up into new heaps In doing this the whole heap is moved a distance of about 5 feet, or a convenient throw with the fork. In making the first turn take care that the wet materials on top are thoroughly mixed with the dry underneath. *All matted lumps should be shaken out with the fork, and the whole heap left in a loose, airy condition.*

Keep one or two iron rods stuck down into each heap to act as rough thermometers After the first turn these should become so hot, within a day or so, that they cannot be grasped in the hand. The temperature will then tend to fall gradually, and the next turn should be given whilst the heap is still quite warm. It should never be allowed to become cold before the next turn is given.

At the second turn the materials should be found to be covered with a greyish white growth of the fungus which is breaking them down. Heavy rains will cool down the upper portion of a hot heap temporarily, but the temperature will rise again after the rain stops. Usually the compost will be ripe after three or four turns, but in some cases more are necessary. At each turn see that the dry and unrotted portions of the heap on the outside are placed inside the new heap, to ensure the killing of diseases, pests and weed seeds by the heat.

Keep the tops of the heaps level, and the sides tidy. When ripe the compost should be like well rotted leaf-mould and have the same smell.

Labour Required.—It has been found that in making compost on the above system, excluding the collection and carting of the wastes to the kraal side, that one native's labour for one day will suffice to make two cubic yards (1 ton roughly) of compost. This means that in one year of 300 working days one native's labour is required for making 600 cubic yards (roughly 300 tons). Therefore four natives in a 300-day year can make more than 2,000 cubic yards of compost.

Rate of Application to Crops.—Ten to sixteen cubic yards of compost per acre is a suitable dressing for maize or wheat on sandy soils. On heavy red, chocolate and black soils, dressings of 12 to 20 yards are suitable. From 100 to 200 lbs. per acre of

a phosphatic fertiliser should be applied in addition to the compost to obtain the best results. The more compost applied, the more phosphatic fertiliser is required to balance the excess of nitrogen; but phosphatic fertiliser is economised since smaller dressings are required than if compost is not used.

The available evidence indicates that compost should be ploughed under the soil, and not covered by disc-harrow, when it is applied to annual crops.

WINTER KRAAL COMPOST.

Kraal composting can be carried on in winter as well as through the summer, but of course a cheap water supply is necessary at the composting site.

Some farmers, particularly tobacco growers, prefer to make their compost in winter, and there is this considerable advantage in doing so that the moisture content of the compost heaps can be properly controlled, and therefore can be maintained near the optiumum. The process, therefore, proceeds more smoothly and rapidly than under rainfall, and finished compost can be turned out in three months or less.

HEAPS OR PITS.

Winter compost can be made either in heaps above ground, or in shallow pits two or three feet deep.

Above ground heaps should be sheltered from the prevailing wind if possible, since the latter causes loss of moisture and a substantial fall in temperature on the windward side of the heaps. For these reasons also the heaps should run across the direction of the prevailing wind so that they shelter each other.

It is also advisable to build the heaps in pairs with a small space of three or four feet between them, so that after the second or third turn when their height has been much reduced the two heaps can be thrown into one. The larger combined heap will hold the moisture and heat longer and will thus mature better, and water will be economised.

PITS.

Where the site for composting, for reasons of economy of transport or otherwise, must be placed in a high exposed situation, or where the water supply is limited, shallow pits should be employed, since they shelter the heaps from the wind, and so reduce evaporation of the moisture. These may be two or three feet deep, not deeper, since aeration will then be unduly interfered with, decay will be slowed down, and loss of nitrogen by denitrification at the bottom of the heaps will be encouraged. A convenient width for the pits is fifteen feet, and a convenient length is 45 to 65 feet. The sides and ends of the pits should be given a slope of 45 degrees, since this ensures that as the heaps settle down no open space is left in which flies can breed owing to the lower temperature. For the same reasons the sides and ends of the heaps do not unduly dry out. The pits need not be dug down the full depth required, since the spoil from the pits can be used to raise the ground level around the pits.

1 The battery of 30 compost pits employed by Mr E W Lamont on the Rhodesia Tobacco Estates, Ltd., for making compost in winter Note the water tower in the centre with two watering points

2 View of one of the pits being emptied Note the sloping walls of the pits and the roads between the rows of pits. Each pit was employed as a cattle kraal.

The battery of pits should be arranged on a rectangular plan, with roadways wide enough for a wagon to pass with ease down between the parallel lines of pits as shown in the accompanying illustration of a well designed battery laid down by Mr. E. W. Lamont in 1939 on the property of the Rhodesia Tobacco Estates, Limited. It will be seen that a thousand gallon water tank has been mounted on posts about 10 feet above the ground in the centre, and from this pipes are run to two watering points, one on either side. From these points a hose enables all the pits to be watered with an adjustable spray nozzle. The tank can be kept filled by two natives working a double-action hand pump.

Ample pressure is developed with this arrangement to give an effective spray at the nozzle. The rectangular design allows of expansion of the battery as required. The pits were 16 feet wide, by 2 feet deep, by 66 feet long, and each pit held approximately 30 tons of finished compost. Therefore at one filling the whole battery of pits yielded roughly 900 tons of compost.

WATER SUPPLY.

In the first stage of the process when the fungi are chiefly concerned in the decomposition, and thorough aeration of the heap is particularly necessary, the percentage of total moisture in the heap should be below 50 per cent., ranging between 40 and 50 per cent. If too much moisture is present at this stage aeration of the heap is interfered with, the fermentation is checked, and the high temperature (between 140° to 150° F.) which is so desirable for killing weed seeds, flies, pests and diseases, is not developed.

The most common fault observed in the making of winter compost is the use of excessive quantities of water. The materials in the heap should be kept just moist; "as moist as a squeezed sponge." Some simple water supply, such as that described above, which will give the small pressure necessary to produce a spray is strongly advised, since a spray is very desirable to ensure even and proper watering of the heaps. The carting of water and spreading by hand, or the use of sumps with distribution of the water by hand, are uneconomical of water and labour. Where an irrigation furrow is available, water can be distributed from this over the adjacent pits by the use of small movable channels of sheet iron to guide it to different parts of the pit.

Howard and Wad found at Indore, in a dry climate, where the pits were sited on a wind-swept plateau, that from 200 to 300 gallons of water were required (according to season) in the making of one cubic yard (roughly half a ton) of finished compost. These figures will assist the farmer in designing his water supply.

FILLING THE PITS.

In order to avoid trampling by the labour on the heap, and so packing it and excluding air, the pits should be charged in sections 5 to 6 feet wide commencing at the end.

A layer of the soiled wastes from the kraal, about 6 inches deep is laid down across the pit to a width of 5 to 6 feet, and this is sprinkled with water so that the materials are just moist, but not soaked. Then successive 6 inch layers are placed on top, each being watered, until the section is built up to a height of 18 inches to 2 feet above ground level.

This procedure is continued until the end of the pit is reached, where an empty space 5 to 6 feet wide is left to allow the heap to be turned. Fermentation should commence immediately, and within 24 hours a high temperature should be developed in the heap. Thereafter the handling of the heap should follow the lines laid down above for summer compost.

At each turning of the heap only sufficient water should be sprinkled over the wastes as they are being turned to maintain them in the condition of moistness of a squeezed sponge. The surface of the heaps may receive a light sprinkling of water from time to time as it dries out.

If the whole pit (save the empty space for turning) is filled in one operation, and not by sections, then trampling by the labour is inevitable, and the heap must receive its first turn immediately after filling the pit. Thus, filling the pit in sections saves one turn of the heap.

In order to assist aeration of the heap it is worth while to make vertical air vents in each section of the heap as it is completed. Three vents may be made across each section, evenly spaced, by means of a crowbar thrust down into the heap and worked with a circular motion to leave an open hole.

ALTERNATIVE METHOD OF FILLING PITS.

The following valuable modification was first introduced by Mr. E. W. Lamont, and can be strongly recommended, since it greatly economises labour.

Instead of first putting the wastes under cattle in separate kraals away from the pits, each pit is temporarily used as a cattle kraal, by erecting a moveable fence of native posts and two or three strands of wire close around the edge of the pit. The wastes are then placed under cattle in the pit as described above for summer kraal compost, and the pits allowed to fill up to ground level, when the fence is moved intact to the next pit

Then a space is cleared at one end of the pit to allow of turning. The heap is then turned, and the wastes watered as they are being turned. This system economises time and labour, since the preliminary treatment of the wastes in separate kraals is avoided.

DUNG SLURRY.

The use of dung slurry when building the heaps or filling the pits, or at the first turn of a heap or pit, will go far to ensure a quick start to the process, and the even decomposition throughout the heap which is to be aimed at.

Dung slurry is a thin mixture of fresh moist dung stirred up with water. The addition to the slurry of a little wood ashes, and a little material covered with the white fungous growth from another active heap, can also be made with advantage.

The slurry should be lightly and evenly sprinkled over the wastes.

Heaps which do not heat up properly after the first turn may well be treated with dung slurry whilst turning them.

Agricultural Experiment Station, Salisbury.

ANNUAL REPORT OF EXPERIMENTS, SEASON 1940-41.

By H. C. ARNOLD, Manager.

On the whole, the season was an unfavourable one for most crops and the yields were lower than the average. The season opened with copious rains, but soon after the planting season commenced a rainless period lasting for nearly a month checked the growth of the young plants, and in some cases prevented or delayed germination, causing irregular stands. The drought was followed by heavy and continuous precipitations with a lack of sufficient sunshine to promote normal growth. Finally, little rain fell during the month of March, and premature ripening resulted in reduced crop yields.

ANALYSIS OF RAINFALL, SEASON 1940-41.

Month	No. of rain days.	Total for the month	No. of rains over ½ inch.	Total to end of month	Periods exceeding one week without rain
October ...	3	2.29	3	2.29	Oct. 18th to Nov. 2nd.
November ...	11	5.05	6	7.34	Nov. 25th to
December ...	13	7.32	6	14.66	Dec. 17.
January ...	24	9.44	12	24.10	Nil.
February ...	14	5.71	5	29.81	Nil.
March... ...	8	1.96	2	31.77	Mar. 1st to 12th.
April		Nil			
Totals...	73	31.77	34		
Average for the previous 10 years ..	78	32.34	39		

This analysis shows that although the total amount of rain precipitated was about equal to the average for the previous ten years, there were fewer rain days and a smaller number of effective showers. It is seen that over two-thirds of the total precipitation occurred during the ten-week period between December 17th and February 28th, leaving less than one-third for the remaining part of the season.

The results of experiments conducted at this Station since the year 1919 are available in Bulletin form, and to facilitate comparison, this report is drawn up on lines similar to previous ones.

The trials in which the effectiveness of various methods of fertiliser placement were compared have been discontinued as they have now served their purpose.

CROP ROTATION EXPERIMENTS.
FIRST SERIES 19713-1941.

Maize Yields in Bags per Acre.

Symtem of Cropping.	1940-41. Rainfall 31.77	1939-40. Rainfall 37.97	1938-39. Rainfall 51.33	1937-38. Rainfall 29.47	1936-37. Rainfall 32.68	1935-36. Rainfall 24.01	Average Yield.
*A1—Maize continuous. Green manure and 250 lbs. per acre of phosphatic fertiliser in the following season	8 53	17 70	Green Manure ploughed under.	10.53	16.10	Green Manure ploughed under.	12.77 (9 crops)
*A2—Maize continuous. Fertiliser only, rate as above.	4 33	9.5	2 33	5 49	9 10	6.12	6.36 (13 crops)
†B—Alternate maize and beans for hay; no manure or fertiliser.	6.58	8.22	2.70	8 36	5.60	11.70	8.75 (26 years)
C — Three-course rotation: Maize, velvet beans (reaped), oats; no manure or fertiliser.	8 00	10.79	8.07	9 83	5 80	13 25	12.49 (26 years)
D — Four - course rotation: Maize (plus 6 tons dung per acre), oats, bean hay maize. Average of two plots.	12.62	13.46	5.74	11.69	14 30	14.82	
Maize (no manure direct).	15 20	14.45	6.19	9.78	14.70	16 63	15.98 (25 years)
Maize (dunged plots).	10.03	12.48	5.28	13.60	13 90	13.00	15.38

*NOTE.—Having grown maize for 15 years in succession without manure or fertiliser, during which time its yields gradually decreased until they had become so low as under practical field conditions to have rendered them negligible, this plot had served its purpose. With the object of comparing two methods of again raising the cropping power of such land to a more profitable standard, the whole plot was treated with a mixture of one-third bone meal and two-thirds superphosphate at the rate of 250 lbs. per acre at the beginning of 1928-29. One-half of the plot was sown to a mixture of sunnhemp and velvet beans, which were subsequently ploughed in. This manurial treatment was repeated on the respective plots during the seasons 1932-33, 1935-36 and 1938-39.

†In 1929-30 this system was amended from "Alternate Maize and Bare Summer Fallow" to "Alternate Maize and Beans for hay."

System A.—The average yield over thirteen years is seen to be twice as great on the green manured section as it is on the land which has had fertiliser only. The total yields during the thirteen-year period favour the green-manured section by 32 bags per acre.

System B.—The yield in this system is comparatively high and it seems to show that although only the roots of the previous leguminous hay crop were ploughed under, they have enabled the maize crop to resist the harmful effects of adverse weather conditions to a certain extent.

System C.—The yield of eight bags per acre from this land illustrates the beneficial effect of rotational cropping. This yield is nearly as large as that obtained in System A. where the land receives fertiliser and green manure. In this System no fertiliser is applied. but the top growth of the velvet bean crop is ploughed under after the seed has been reaped. The stabilising effect on the yield of maize, of rotational cropping combined with the return of a part of the crop residues to the land, is demonstrated on these plots where, during the past four years, the yield has varied little either above or below nine bags per acre. This season's yield is only 1¼ bags per acre less than the average for the previous ten years.

System D.—The yields here are higher than those of System C because the kraal manure adds plant foods to the land. Under normal farm conditions where crop rotation is practised, a proportion of the produce of the land will be fed to livestock, and manure will be available for application to the arable lands. The beneficial effect of rotational cropping combined with humus applications is demonstrated again by these results.

SECOND SERIES OF CROP ROTATIONS.

These rotations were laid down in 1919 20 and were designed to evolve a system of cropping which would meet the needs of farmers who could not adopt a system of mixed farming The series includes two plots, A. and F., on which maize has been grown continuously, excepting that, in the season 1938-39 on one half of Plot A. a green manure crop was grown, the top-growth of which was composted and returned to the same plot in order to ascertain the effect of a humus dressing on land which has been continuously cropped to maize for twenty years. No artificial fertiliser has been applied to Plot A. at any time. On Plot F., commencing season 1929-30, phosphate fertiliser is applied in alternate years The fertiliser treatment given to this plot is the same in quantity and quality as that accorded in rotational system H., but humus dressings are entirely omitted.

During the season under review, further changes were made in this Series, affecting rotational Systems F. and H. At the time of their inception, maize was the only "cash" crop that could be grown on a large scale in this Colony, but during the past few years strains of soya beans suitable for large-scale cultivation have been introduced and may, at some future date, form a welcome addition to our cropping system. With the object of ascertaining the effect of introducing soya beans into these systems of cropping, the original plots were divided so that in future the old system will be continued on one half, adjacent to the amended system on the other half of the plots. The yields of the soya beans and maize grown on the sub-plots in the amended rotation were published in the September, 1911. issue of the Rhodesia Agricultural Journal.

System E., Plot A.—Maize continuously for twenty-two years. Commencing season 1939-40, on one half (A.1.) green manure crops were grown, the top growth of which was composted and returned again to the same plot. During the season under review maize was grown on both of the sub-plots, which are now designated A.1. and A.2. No fertiliser has ever been applied to this land.

Seasons and Yields of Maize in bags (200 lbs.) per Acre.

	1940-41.	1939-40.	1938-39.	1937-38	1936-37.	1919-20.	Average 22 years.
A.1.	6.95	12.10	Green manure composted	—	—	—	—
A.2.	4.63	7.33	3.63	3.89	3.80	25.25	8.49

These returns show that the beneficial effect of the humus dressing given in a previous season has lasted over the two seasons, and is responsible for a 33% increase in yield during the season under review. Over the three seasons, an increase of 3½ bags per acre has been obtained where humus was applied.

System F., Plots B. to E.—Three-quarters of the land under maize, one quarter under Sudan grass. Each year one section under maize commencing with Plot B. in 1919-20, receives eight tons of farm manure per acre, and commencing on Plot E. in 1929-30, the section which grew Sudan grass the previous season receives 200 lbs. per acre of superphosphate (19% P_2O_5).

Maize Yields in Bags of 200 lbs. per Acre.

	1940-41	1939-40	1938-39.	1937-38.	1936-37.	1919-20.	Average 1920-41
Plot B ..	10.52	17.15*	6.45†	Sudan	11.50	26.0	15.80
Plot C ..	10.55*	13.83†	Sudan	11.74	14.75*	23.7	14.75
Plot D	7.60†	Sudan	7.25	12.64*	15.25†	Sudan	14.50
Plot E .	Sudan	16.99	9.45*	10.69†	Sudan	24.6	15.31
Average	9.56	15.99	7.81	11.69	13.83	24.7	15.09

*Indicates the application of farmyard manure.
†Indicates the application of 200 lbs. per acre superphosphate

Although maize occupies the land for three successive seasons in this system, and the yields are subject to wider fluctuations, due to seasonal climatic conditions, than those in Systems C. and D., the influence of the kraal manure is reflected in higher average and less fluctuating yields than those obtained in System G (below) where twice as much fertiliser, but no humus, is applied to the land.

System G., Plot F.—Maize continuous. No manure or fertiliser during the first ten years. Commencing season 1929-30 fertiliser similar in kind and in quantity to that provided in System H. has been applied to this plot.

Seasons and Yield of Maize in Bags per Acre.

1940-41.	1939-40.	1938-39	1937-38.	1936-37.	1935-36.	1919-20.	Average over 21 years
5.95	11.40*	3.93	7.79*	6.65	16.26*	23.3	10.5

*Indicates the application of 200 lbs. per acre fertiliser.

The lack of humus in this land is reflected in a yield which is only half as large as that of the previous year.

System H., Plots G. to K.—Three-quarters of the land under maize, one-quarter under velvet beans, which are ploughed under for green manure. From the commencement of this experiment until 1928-29 this land received one green manuring and one

application of fertiliser during each period of four years. The returns from these plots showed that insufficient plant food had been supplied to maintain fertility, and the manurial system was then amended to provide for two dressings of fertiliser during each four-year period. The crop of maize which follows the green manuring now receives 200 lbs. of 19 per cent. superphosphate per acre, which should enable it to make the best use of the nitrogen supplied by the green manure; the second maize crop receives no fertiliser, and the third crop, that immediately in front of the green crop, receives 200 lbs. per acre of raw rock phosphate.

Maize Yields in Bags per Acre.

	1940-41.	1939-40.	1938-39	1937-38.	1936-37	1919-20.	Average 1920-41.
Plot G .	9.40*	10.52	14.23*	Beans	11.20*	23.10*	13.96
Plot H ..	8.10	21.35*	Beans	8.40*	9.90	23 00	14.96
Plot J .	. 20.65*	Beans	3.79*	9.86	20.56*	Beans	13.55
Plot K .	Beans	12 58*	4.58	18 18*	Beans	19.20	13.82
Average	12.72	14.82	7 53	12 15	13.89	21 70	14 07

*Denotes the application of fertiliser

The remarkably heavy yield of 20.65 bags per acre on the plot which was green-manured in the previous season, supports the view that applications of humus are the best means available to the farmer for counteracting adverse weather conditions.

THIRD SERIES OF CROP ROTATIONS.

In the season 1926-27 two more rotational systems were laid down, which have been designated Systems M. and O. respectively.

System M.—This is a four-course rotation in which the sequence of the crops is:—Maize+200 lbs. per acre of superphosphate; ground nuts and sunflowers; maize+200 lbs. per acre of raw rock phosphate; green manure. Hence one half of the land is sown to maize, one-eighth to sunflowers and another eighth to ground nuts, and one-quarter is green-manured. In the following tabulation the yields of the various plots are expressed in bags per acre, a "bag" of maize being 200 lbs. and a "bag" of ground nuts 65 lbs.

	1940-41	1939-40	1938-39.	1937-38	1936-37	1926-27.	Average maize yield 1926-41.
Plot A	N.17.6	20.13*	G.M.	9.66*	N 14.3	G.M.	13 63
Plot B ..	16 56*	G.M.	6.75*	N 17.9	15.72*	15.15*	11.70
Plot C .	G.M.	14.60*	N 8.0	11 48*	G.M.	N.21.0	13.32
Plot D ..	13.20*	N.16.3	9.54*	G M.	14.88*	12.06	11.65
Average maize yield	14.88	17.37	8.15	10.57	15.30	13.88	12.57

*Denotes the application of fertiliser.
G.M.—Denotes the application of green manure
N.—Denotes the position of the ground nuts in the rotation.

The manurial treatment given in this rotation is the same as that accorded in System H. The difference is in the method of cropping. In System M., although the yield of maize following green manure is not as heavy as that obtained in System H., the intervening crop of maize is much heavier than those in the

old system, making an average maize yield of two bags per acre more. The yield of 17.6 bags per acre of ground nuts would be more profitable than the 9 bags of maize obtained in System H. In spite of the unfavourable weather the yield of maize obtained here this season is 2.3 bags per acre more than the average yield for the period 1926-41. This may be attributed to the diversified system of cropping in addition to adequate manurial treatment.

System O.—The order of rotation is:—Maize fertilised with 200 lbs. per acre of raw rock phosphate; sweet potatoes; maize which receives a dressing of 8 tons per acre of farmyard manure; hay crops. This system is typical of a rotation suitable for dairymen or others who prefer to feed a large proportion of their crops to livestock. In practice it would probably be found necessary to make alterations to meet individual requirements, such as altering the proportion of maize to other crops; leaving the sweet potatoes down for two years, or reducing the amount of land under sweet potatoes and growing pumpkins and melons instead. Whatever the details of the adopted system may be, if the principles on which this rotation is based are adhered to, similar results could be expected.

In the tabulation below are shown the acre-yields of maize in bags of 200 lbs. and of bean hay and sweet potatoes in tons.

Seasons and Yields in Bags (or Tons) per Acre.

	1940-41.	1939-40	1938.39	1937 38.	1936-37.	1926-27	Average maize yield 1926-41.
Plot F ..	P. 2.7	15.69*	H. 1.20	12.03†	P. 1.02	H. 1.1	16 69
Plot G .	15 96*	H 2.34	7.54†	P. 1.52	15.61*	19.65	14.41
Plot H	H. 1.04	17.95†	P 2.7	11.73*	H. 2.29	P. 6.1	17.26
Plot J .	10 40†	P.13.9	12 53*	H. 1 32	14.85†	16 45*	12.27
Average maize yield ..	13.18	16.82	10.04	11.88	15.23	18.05	15.13

*Denotes the application of fertiliser.
†—Denotes the application of farmyard manure.
P—Denotes the position of the sweet potatoes in the rotation.
H—Denotes the position of the bean hay crop.

The yields of maize in this rotation during the past two seasons have been lower than those in System M., and instead of being higher than the average for the period 1926-41, this season's yield is considerably lower.

It would appear that the sweet potato crops have made heavier demands on the land than the ground nuts, and that the manurial treatment in System O. is not liberal enough to replenish the plant nutrients removed from the land by the crops.

In general, these trials show that rotational systems of diversified cropping in which the soil treatment includes adequate dressings of humus and phosphate, provide the best means of maintaining the production of maize at a moderately high and stable level and that, to some extent, such systems form an insurance against the vagaries of the weather.

Methods of Utilising Sunnhemp Crops for the restoration of Soil Fertility.—These trials were commenced in the season 1935-36, and the results of the first series were published in the Agricultural Journal for September, 1938. With slight amendments the

trials were repeated again on the same plots and the results were published in the May 1941, issue of the Agricultural Journal. During the season under review sunnhemp was again sown on the appropriate plots and the treatments previously given were repeated again on the same plots as before, excepting for a slight variation in the case of the (d) and (e) treatments. In the previous trials the top growth of the sunnhemp grown on the (d) plots was removed, composted, and applied to the (e) plots, but in the series commenced this season, the sunnhemp was grown on the (e) plots, and the compost made from its top-growth will be applied to the (d) plots. The growth of sunnhemp was considerably heavier on the (e) plots than any of the others. This was rather surprising, because the yields of maize obtained from these plots during the previous five years had been lighter than that of plots under other treatments. The reason for this is not fully apparent, but is probably due to the sunnhemp being able to utilise certain plant nutrients which were locked up in the soil in forms in which they could not be utilised by the maize crops previously grown on these plots.

In another series of trials in which various methods of treating sunnhemp are compared, the treatments were as follows:—

(a) Whole crop ploughed under in the usual way at 18 weeks after germination of seed.

(b) Top growth removed at 18 weeks after germination and the stubble ploughed under on the same day.

(c) Top growth removed at the same time as in (b) but ploughing of land delayed until the land under (d) treatment is ploughed.

(d) Sunnhemp reaped for seed, stalks removed, mature stubble ploughed in during the winter months (July or August).

All of these treatments were replicated on ten plots, and during the two seasons which followed the land was cropped with maize.

In the tabulation below the average yield of maize reaped on each series of ten replicated plots is shown.

Yields of Maize in Bags per Acre.

	A. Whole p u.	B. Stubble p u early	C. Stubble p u. late	D. Stubble of mature crop
First Series -				
1939-40	16.46	14.23	14.74	15.11
Second Series—				
1939-40	27.24	24.88	25.18	25.86
1940-41	12.56	10.64	10.62	11.72
Totals—two series	56.26	49.75	50.54	

These returns show a consistently larger beneficial effect where the whole crop was ploughed under, but the yields obtained where only the mature stubble was ploughed in and the seed was

harvested, indicate that, provided the yield of seed is a reasonably good one, that method might prove to be the most profitable, particularly if the sunnhemp stalks were eventually returned to the land in the form of compost. The beneficial effect on the maize crop was less where the stubble only, of the immature crop, was ploughed in. The sunnhemp was cut at a stage which is too late for making good hay, and unless the top growth can be used to some special purpose there is nothing to be gained by this method of handling the crop.

GROUND NUT STRAIN TRIALS.

During the season 1939-40 two new varieties of ground nut were introduced from the West Coast of Africa. One is known as Indian Coromandel, and the other is called "Gold Coast," after its country of origin. These have been included in trials with our two best known varieties, namely, Valencia and Virginia Bunch, for the past two seasons. In these trials Valencia has been affected by *Fusarium* wilt disease which has reduced its yield to some extent. The results are shown in the following tabulation.

Yield in Bags (65) lbs. per Acre.

	Season 1939-40.	Season 1940 41	Average of two seasons
Virginia Bunch... . .	36.9	19.7	28.3
Valencia	30.8	7.8	19.3
Indian Coromandel ..	35.3	10.7	23.0
Gold Coast	17.5	9.8	13.7

The Indian Coromandel nuts contain a higher percentage of oil than the other varieties and, for that reason, they would be preferred by manufacturers who utilise oil for soap. On the other hand, Virginia Bunch has a larger proportion of protein in its seeds and it also produces more top-growth, which can be converted into hay. For these reasons it would be the most suitable kind for those farmers who wish to feed their ground nuts on the farm.

SWEET POTATO VARIETY TRIALS.

The increased attention being given to the feeding of livestock during recent years has revived interest in this crop. The Russian variety named Virovsky, which was obtained through the courtesy of the Department of Agriculture, Pretoria, some four years ago, has consistently out-yielded the older and better known varieties. It has an agreeable flavour and it yields heavily. It is, therefore, suitable for growing for both human and animal consumption.

During the season under review, seven varieties were included in our trials, and the plots were replicated three times. Owing to the uneven distribution of the rain, the yields were considerably lower than those of other seasons, but the varieties which proved to be best in previous trials have (after Virovsky) maintained their respective positions.

Yields of Tubers in Pounds per Acre.

Virovsky	10,160 lbs.	Russian W.33 ...	7,933 lbs.
Linslade	8,547 lbs.	Red Nancemond	7,773 lbs.
Early Butter... ...	8,227 lbs.	Southern Queen .	4,733 lbs.
Calabash Leaf ...	8,013 lbs.		

Seed Maize Production.—The investigations mentioned in previous reports which have the production of so-called hybrid seed for their object are being continued. Some of the strains which have been "selfed" for the past eight years, now exhibit that uniformity of physical characters which distinguishes inbreds from ordinary open-pollinated stock. A number of crosses between these inbred strains were sown in trial plots in which the control plots were sown with an open-pollinated variety obtained from a well-known local farmer who has selected his stock very carefully for the past twenty-five years. The uniformity among the individual plants from the hybrid seed was most marked, all the plants in each plot being almost exactly alike. When these plots were harvested it was found that a fair proportion gave yields which were definitely heavier than those of the control strain, several gave yields slightly better than the control and others appeared to be lighter yielders than the open pollinated stock. These results indicate that it will be possible eventually to combine compatible inbred strains in such a way that increased yields will be assured. Progress is necessarily slow because such a long period intervenes between the time when the strains are crossed and the result of the combination is known. For example, when two inbreds are crossed the result is not fully apparent until the end of the next season, at which time it is too late to repeat the crosses which show the most promise The work must be held over until the following year when the crosses made two years previously can be repeated, but the value of the combination of strains will again not be fully apparent until the end of the next season.

Further testing of the crosses which have given the best results is necessary to determine whether they will consistently out-yield the best strains obtainable from other sources, before propagation on a larger scale with a view to using them for the commercial crop will be justifiable.

Soya Beans.—The work performed in connection with this crop was described in an article published in the September, 1941, issue of this Journal, and is now obtainable as Bulletin No. 1183. About 200 farmers availed themselves of the offer of free seed, and soil to inoculate purchased seed, under the Government scheme of co-operative experiments. By this means the improved strains have been distributed to all parts of the Colony, and when the Agriculturist has received the reports of the farmer co-operators at the close of the season, much valuable information regarding the suitability of the various strains for the different districts will be gleaned. An endeavour is being made to improve the cropping power of these beans still more by crossing Hernon strains with Potchefstroom No. 184.

Velvet Bean Hybrids.—Seed of the two new strains called Marbilee and Jubilack was distributed to farmers at the beginning of the season, and nearly all the reports received agreed that it produced much heavier crops of fodder than the Somerset variety. In some cases sowing was delayed through the lack of rain and the crop of seed obtained was disappointing. Growers of these strains need to keep in mind that the reason they produce heavier crops than other kinds is mainly because they continue growing for a longer period, hence, if a crop of seed is required they

should be allowed the longest possible period for growth by sowing them before the middle of November, whether the seasonal rains have commenced or not. The large seed provides sustenance for the young plants, so that even if the rainfall is scanty at the beginning of the season, the seedling plants survive and make rapid growth as soon as favourable weather conditions arrive. If it is given an early start the Marbilee variety produces as much seed as Somerset. Jubilack usually produces rather less seed, but the vine growth is very considerably greater, and for this reason, when the production of hay is the object, it is superior to the other varieties.

Cowpeas.—In the season 1936-37 a variety of cowpea called "Turiani" was introduced from Australia and it proved to be the best fodder variety among a number we had on trial. In subsequent trials at this Station it has produced a satisfactory crop of fodder, but its yield of seed has been lower than that of other kinds Seed of Turiani has been supplied to a number of farmers, and very favourable reports have been received. It requires a considerably longer season to reach maturity than "New Era" and the "Upright" strains which have been produced at the Potchefstroom Experiment Farm and issued to farmers during recent years. Some half dozen strains of the Potchefstroom Uprights have been under trial here since the season 1937-38. On this Station their yield of fodder has been rather disappointing, as it is usually considerably below that of Turiani and no better than that of the native beans, but their erect habit enables the farmer to reap his hay with a mowing machine. They are also very suitable for areas with a scanty rainfall, because they are very drought resistant and quick maturing. The best strains are 34 C. 361 and 34 C. 408. Both of these have seed which is small in size and reddish brown in colour.

These strains have been crossed with Turiani and New Era with a view to the production of strains which will combine the good qualities of their parents and be more suitable than they are for local climatic conditions.

WOE TO WEEVILS.

You can say " Whoa!" to weevils, but the weevils whoan't. You need to **do** something about it.

Get a copy of Bulletin No. 1161 on weevil control (3d.) and follow its suggestions, including advice on cleanliness in lands and in sheds. It contains food for thought and should help you to PRODUCE and PROTECT food for Victory.

Deeds, not words, should be your goal;
Cleanliness Aids Insect Control.

Some Light on the Sprouting of Seed Potatoes.*

By E. T. MORGAN, Officer-in-Charge, Potato Branch, Department of Agriculture, Perth.

It will have been noted by many growers of potatoes that where tubers have been stored for some time and are reaching the sprouting stage, injured and severe scab-affected potatoes are inclined to "shoot" before those that are not so affected. The cutting of potatoes into sets for planting induces quicker sprouting and where cut sets and "round" seed, from the same crop, have been planted at the same time the emergence of growth has been in favour of the "cut" seed by from seven to twelve days.

Research work carried out by Norwood C. Thornton and published in the *Contributions from the Boyce Thompson Institute*, Vol. 10, 1939, has thrown considerable light on the subject. This article quotes, "The generally accepted explanation of the inability of freshly harvested potato tubers to sprout when replanted at once after harvest is that the buds do not get enough oxygen from the air, that the peel is at first impermeable to this gas; and that germination of buds becomes possible only later when the peel becomes more permeable and permits the entrance into the tuber of a sufficient supply of oxygen. The corollary to this view is that the normal oxygen content of the air (20 per cent.) would be sufficient and possibly the optimum for germination if the buds could get it.

"The present paper shows that the failure of the potato buds to grow is due to the oxygen content of the air being too high, not too low, and that growth can be initiated at once, if the oxygen concentration is reduced from 20 per cent. (normal) to approximately two to 10 per cent., and further, that the peel of the freshly harvested tubers is not impermeable to oxygen, but is, in fact, more permeable at that time than at any later stage, that its permeability decreases, not increases, with time until a point is reached at which the supply of oxygen to the buds has been reduced to furnish these low concentrations which are required for sprouting to proceed

"The young tuber has no membrane that will inhibit the passage of oxygen and it is not until the later stages of its life span that the skin becomes dense, more cells are present and the cell walls become thicker. The natural growth of this membrane to a point at which entrance of oxygen is restricted marks the end of the period of rest of the tuber and furnishes the conditions for the development of new plants. If wounded (by peeling the

*Reprinted from the Journal of the Department of Agriculture, Western Australia.

surface or cutting into pieces), dormant tubers will sprout, not because of a mechanical facilitation of the entry of oxygen as had been previously supposed, but because of a retardation in the entry of oxygen by the formation of dense 'wound cork' tissue that the tuber rapidly develops."

Under experimental conditions freshly harvested potatoes sprouted in seven days when held in five to 10 per cent. of oxygen under a moist condition, in nine when held in two per cent. of oxygen under a dry condition, whereas sprouting of the potatoes did not take place until 47 days after harvest, when the tubers were held in 20 per cent. of oxygen.

Acknowledging that tubers stored under ordinary farm conditions will sprout only when the skin or periderm of the potato thickens sufficiently to allow decreased oxygen supply to the buds, what environment is most desirable if quick sprouting is needed?

In the experimental work quoted, cutting and peeling of tubers induced quicker sprouting, but, inasmuch as such methods are impracticable, other than on a very small scale, little of practical value to the farmer is learned. Other conditions which have an important bearing on the thickening or otherwise of the periderm are the effects of dry and moist storage. Moist conditions facilitate, and dry conditions retard the formation of the periderm. This is the reason given for the fact that potatoes stored under moist conditions will sprout earlier than potatoes stored under dry conditions. It would thus be possible for growers to some extent to regulate the sprouting of their tubers by attention to storage conditions. It has been known to many of us that potatoes stored under moist conditions have sprouted comparatively quickly; some growers have used various solutions, such as nitrate of soda and sulphate of ammonia with water, and have claimed that such solutions when sprayed over the tubers have hastened sprouting. While such solutions may or may not have a beneficial effect, it would appear evident that the spraying to which the potatoes have been subjected would create a moist condition which would enable the skin to thicken sufficiently to hasten sprouting.

It is felt that many growers will be interested in the findings of the experimental work quoted; on a subject which, so far as is known, has received but little attention.

[In connection with the above article, it may be noted that treatment of tubers with carbon bisulphide in an airtight container, to induce sprouting, is carried out by some farmers in this Colony. The method, however, has not yet been fully investigated with a view to obtaining uniform sprouting, etc. Further information might be available at a later date.—Editor.]

Issued by the Food Production Committee.

Hints on Vegetable Growing in Southern Rhodesia.

By G. W. MARSHALL, Government Horticulturist.

In a short article such as this it is possible to set down only the main points to be observed in the successful cultivation of vegetable crops, and the most efficient utilisation of land devoted to their growth, whether in gardens, allotments or areas of greater extent. For the same reason, only the better known vegetables will be dealt with, omitting those that are less generally grown or are not essential in the maintaining of an adequate and varied supply throughout the year.

It is generally recognised that vegetables contribute in a very large measure to a full and complete diet, which consists of an adequate supply of carbohydrates, protein, fats, mineral salts and vitamins. The food value of vegetables depends on their content of these various substances. Potatoes and the root vegetables are rich in carbohydrates, peas and beans are rich in protein, whilst other vegetables also contain this food factor, though in smaller amount. All vegetables supply valuable mineral salts, along with various vitamins, that are essential in the diet if health is to be preserved and protected.

Soils.—For general purposes the best vegetable soils are medium loams that contain a high percentage of humus or organic matter derived from the decomposition of manure, leaves and vegetable materials of all kinds. These soils are free in texture but retentive of moisture. They absorb and retain heat and admit of a free circulation of air which is necessary for healthy root development, and for the production in the soil of available plant foods.

Many soils fall short of the loamy condition so desirable for vegetable growing, but may be altered and improved in texture and composition so as to modify their faults. Light, sandy ground is improved by liberal dressings of compost or rotted manure. Stiff clay soils may be improved by digging in strawy manure, tree leaves, vegetable refuse, sandy material and applications of agricultural lime (1 lb. to 2 square yards of soil) which breaks up a stiff soil and makes it more friable.

Soil Preparation.—In this Colony with its many acid soils, the best results are usually obtained when the soil is dug to the depth of from six to nine inches only. Improper trenching or digging that exposes and mixes a high percentage of sub-soil with the surface soil is harmful to many vegetables and should be avoided. Trenching is essential for perennial crops like rhubarb and asparagus, but even then the trench should be refilled with surface soil only, but as these slow growing crops are not being dealt with now we need not consider this factor.

If the area selected for planting to vegetables is dug to the depth indicated, preferably with a four-pronged digging fork when the soil is still moist after rains or irrigation, it should be in good condition for making into convenient sized beds. (A garden bed that can easily be planted, weeded or watered is one of 4 feet 6 inches in width with an 18 inch path alongside. Narrower beds are wasteful.)

Remove the loosened soil from the pathway and place it on top of the bed, apply the compost, manure or fertiliser to be used and re-dig, then rake to a nice level bed surrounded by a slight mound of the coarser lumps of soil. This mound will prevent rain or irrigation water from runing off. The prepared bed is now ready for planting to seed or transplants, or both. The length of the beds is optional, but arrange them with the paths leading to the water supply or contoured with a suitable fall for irrigation. These raised beds are essential with most of our heavier soils, since they drain more readily during very wet periods and less trouble is experienced from diseases caused by excessive moisture.

Manures and Fertilisers.—If the soils to be planted are either new or old they will require adequate amounts of suitable plant foods. These need not be stated here, but for best results all of the important elements should be in the soil. These are to be found in manures, compost and complete chemical fertilisers, but as the latter are likely to be difficult to obtain in the not distant future gardeners will have to concentrate on the production of compost as suggested in Mr. S. D. Timson's Bulletin No. 1194, "Garden Compost." This compost contains all of the important plant food elements and good healthy crops are assured by its use. Animal manures are also suitable if they are well rotted, but these materials are of more value when they are passed through the compost pits or stacks before applying to the soil.

The amount of manure or fertiliser to apply to the average garden soil depends on many factors, but good results may be expected from dressings of 15 to 17 tons of compost

per acre. This represents a layer of about one quarter of an inch over the surface of the bed. Dressings of bone meal or other phosphatic fertilisers should be used in combination with compost. Two ounces to the square yard is the usual dressing for most crops.

If a complete high grade chemical fertiliser is available or procurable, satisfactory to good results may be expected from average soils and most crops when applications of one pound to five square yards is made. This treatment is only advised if no manure or compost is available for immediate use. If this fertiliser is used in combination with compost, reduce the application by one half.

Seed Sowing and Quantities.--Good fresh seed is difficult to obtain now, since a considerable amount of the more popular varieties was produced in the south of France. Our seedsmen have now been compelled to try other sources of supply, also new and untested varieties. Some of the seed now imported is of doubtful quality. Furthermore, it may be old stock that may not germinate, but these factors are beyond our control and we must not be discouraged by a few failures.

As seed is difficult to obtain and the prices are high, gardeners are advised to sow it thinly rather than thin out the plants and thereby waste any seed. Broadcasting of seed is unsatisfactory. All plantings should be made in rows or drills, even in the boxes or frames used for raising plants. Better spacing may be arranged and the seedlings are able to obtain sufficient air and light necessary for healthy growth.

The surface soil should be made very fine for seed sowing, whether in the seed-tin, box or bed for transplanting later, or in the open ground where the crop is to mature. It is necessary to sow at the proper depths, placing small seeds nearer the surface and larger seeds proportionately deeper, and in all cases to sow somewhat deeper than the average in light sandy soil, and nearer the surface in heavy clay.

SEED TABLE.

Kind of Seed.	Depth to sow.	Quantity. Length in Rows.	Espacement.
Beans, bush	2-3 inches.	1lb. to 170ft. row	6in. between plants and 2ft between rows.
Beans, climber ...	2-3 inches.	1lb. to 200ft. row	6in. between plants and 18in. between rows and place support between rows.
Beetroot ...	1¼ inch.	1oz. to 100ft. row	Transplant to 6in. apart and 12in. between rows, or sow in situ.

Kind of Seed.	Depth to sow.	Quantity. Length in Rows.	Espacement.
Cabbage ...	¾ inch.	⅛oz. to 200ft. row	Transplant from seed bed 18in. apart for small sorts and 30in. for large varieties, 30in. between rows.
Cauliflower	¾ inch.	⅛oz. to 200ft. row	Do.
Carrot	¾ inch.	¼oz. to 100ft. row	Sow in situ plants 2ins. apart and 12in between rows.
Egg plant ...	1 inch in beds	¼oz to 200ft. row	Transplant 18in. apart and 30in. between rows
Leek	1 inch in beds	¼oz to 200ft. row	6in in rows and 18in. between rows.
Lettuce	¼ inch	⅛oz. to 100ft. row	Transplant or in situ, 9in. apart and 18in. between rows.
Onion	1 inch.	¼oz. to 100ft. row	Transplant 4in. in rows and 12in. between rows
Parsnip	1 inch	½oz. to 100ft row	Sow in situ rows 18in. apart. Thin plants if necessary.
Peas	2 inches.	1lb. to 200ft. row	6in. in rows and 2ft between rows.
Radish	1 inch.	½oz to 100ft.	In situ as companion crop between cabbage, etc : 1in. apart in rows
Pumpkin ..	2 inches.	1oz. to 20 hills	Hills 6 x 6ft. apart
Spinach. . ..	1¼ inches.	1oz. to 100ft row	Transplant or in situ 6in in rows and 18in between rows.
Tomato . ..	½ inch.	⅛oz. for 200 plants	Transplant 3 by 3ft apart and stake.
Turnip	½ inch.	¼oz to 100ft. row	In situ and thin if necessary 4in and 18in. between rows.
Vegetable marrow ..	2 inches.	½oz. to 20 hills	6 by 6ft. apart.

CULTURAL HINTS, PLANTING SEASON AND GOOD VARIETIES.

Beans, bush.—A valuable and easily grown vegetable. For small families plant a 50 foot row every month commencing in August and finishing in March; a little earlier and later in frost free areas. Subject to rust and anthracnose during wet spells. The variety "Victory" is outstanding and fairly disease resistant, harvesting period short; produces heavy crops and any surplus may be used as dried haricot beans later. Black Wonder and Red and White Canadian Wonder beans are also popular varieties. A good catch crop since it matures quickly.

Beans, runner.—Plant from August to January. "Everbearing" is a heavy and continuous cropper for several months, provided pods are not allowed to mature. A dozen or two beans placed along any netting fence, say every two months, will provide the family with really good stringless beans. Tree twigs or reeds will be suitable for supports in the absence of fences. Dry beans of this variety are suitable

for cooking. Save sufficient seeds from all varieties of beans for the following season's planting. Store in fruit jars or tins with tight fitting tops to exclude bean weevil infection while in storage.

Beetroot.—Useful for salads, easily grown, may be planted monthly through the year. Quarterly planting of a twenty foot row will meet the requirements of most homes. Globe varieties for summer and Egyptian of flat sorts for winter planting. Detroit Dark Red (globe) and Flat Egyptian do well in the Colony, often transplanted as a companion crop between the rows of slower maturing vegetables.

Cabbage.—One of the most important green vegetables. Subject to many pests, but these may be controlled by spraying or arranging the planting programme to leave a gap of three months when no cabbages or allied plants will be in the garden. Continuous cropping permits of pests passing from crop to crop until it becomes impossible to grow these vegetables. May be planted throughout the year, but this is not advised. Make a small planting of three varieties (early, mid-season and late maturing) in January or February and a second one in May. The crops will then be suitable for harvesting from March to November. About 100 seeds of each variety planted thinly in a box will provide sufficient plants. Transplant when 3 inches in height during the cool of the evening or a dull day. Lift with a small ball of earth attached to the roots if possible. Avoid deep planting. (Top of roots not more than 1 inch below soil surface.) Good varieties are: Oxheart or Early Jersey Wakefield (early), Surehead (mid-season) and Cape Spitzkool (late).

Cauliflower. — Same treatment as recommended for cabbage. Treat more as a luxury crop. Rather selective in its requirements. Southern Cross and Gilt Edge reasonably successful. Good seed very expensive. Main planting season in autumn, crops mature in spring.

Carrot.—Another valuable crop for the garden. Supposed to do well throughout the year. Plants damp off badly during heavy or continuous rains. Sow a 10 foot row monthly from August to October and again from February to May. These plantings will usually provide crops throughout the year. If roots commence rotting in the ground they may be lifted, washed and the sound ones stored in damp clean sand (river) for several weeks. Protect container from heavy rains and store in a cool place. Oxheart (early) and Chantenay (main crop) are very good. Nantes is excellent and very sweet, but tops detach easily when they are lifted from the rows.

Egg Plant.—An excellent substitute for meat but rather extravagant with butter, in which peeled slices are fried. Half-inch slices pricked with a fork and left in salt water for a few minutes then fried to brown colour, pepper to taste. Sow Black Beauty seed in box in August, then transplant when two inches high. Will fruit over several months if the crops are not allowed to mature. Twelve plants sufficient for the home supply.

Leeks.—Seed almost unobtainable now. All varieties suitable in this Colony. Sow seed in beds during February-April and again August-September. A 25 foot row from each planting should be sufficient. Transplant as suggested for onions, only make the holes with an iron bar six to nine inches in depth, then drop the plant into it with the upper leaves visible. This method will save trenching or ridging to blanch stems. No necessity to refill the holes at planting time. The soil will gradually refill during watering or cultivation.

Lettuce.—This important crop is easily produced throughout the year. Sow a little seed every month in boxes or beds for transplanting. A few plants may be left in the seed beds to provide the first few cuttings. Transplant when 1 to 2 inches in height during dull or cool weather. A few plants should be set in any odd corner for subequent seed requirements. This crop must be grown quickly. Use plenty of water and have fertile soil. Shade for a few days after transplanting or until they are established. Light shade is necessary during the heat of summer (October-November) otherwise the crop will be bitter. A light frame of saplings or split bamboos covered with a very thin layer of dry grass is suitable. If the grass is too thick it will soon rot during heavy rains, and will also produce spindly and poor plants. Support the frame on bricks or forked sticks a few inches above the tops of the plants. These covers are also necessary if severe frosts are likely to occur during winter. The frames are then only used of a night and removed during the day. "Webb's Wonderful" is the outstanding variety, "New York" and "Sutton's A.1" are also very good, but slightly more tender to handle. The Cos varieties are not recommended for the ordinary small garden. Fifty plants a month will meet most cases. Two-pounders are common if the seedlings are well treated. This is the best companion cropping plant that we have. It may be planted between the rows of nearly all other vegetables.

Onions.—Good onions may be grown in the Colony if the following suggestions are adhered to. Plant only Cape

Early Flat or Early Cape Flat Yellow, as it is sometimes called. This variety is derived from the Yellow Bermuda, which is a sub-tropical variety. Globe varieties are usually only suitable for temperate climates; this explains why so many varieties fail to bulb here. Sow seed from February to June. The best main crop period is March. Transplant when the plants are six inches in height and the thickness of a thin lead pencil. Cut the roots off as near the bulb without damaging it as is possible; also shorten the top growth (green) back by one half. Set plants from one to two inches deep in the soil. Use a pointed stick of about $1\frac{1}{4}$ inches in diameter (dibber) for this purpose (the broken top portion of a T or D spade handle is ideal if it is suitably pointed). These dibbers are used for most transplanting operations in the vegetable and flower garden. Make a vertical hole to the required depth then set the transplant with the severed roots at the correct depth where it should be held. A second hole is then made with the dibber a few inches from the first only slightly diagonally with the two bottom points about meeting. The dibber is then pressed toward the held plant to close the first hole. Remove the dibber and leave the second hole to be closed during the watering operation which follows almost immediately after setting the plant. Watering cans are used for this purpose. Well composted and fertilised soil is essential for onion cropping, since it is a greedy crop. Keep the beds free of weeds and cultivate occasionally or until the bulbs are well formed. The bulbs should be harvested when they are fully developed. This condition may easily be ascertained by pressing the neck of the green top between the finger and thumb just above the visible or buried bulb. If the neck is soft the bulb must be lifted and placed in wind rows along the intervening paths. Set the first handful of bulbs at the end of the path and the second handful placed in front to permit of the green tops of the second lot covering the bulbs of the first lot. Continue the process until all of the suitable bulbs have been lifted. The harvested onions will now represent a wind row of green tops with no bulbs showing other than the last bunch. These should be covered with a handful of weeds or grass.

Leave the onions in the wind rows until the tops are thoroughly dried and it is convenient to plait the tops for storage. The harvesting of the crop when the tops are still green is the secret of successful onion culture in this Colony. These green tops exhaust all surplus moisture present in the bulb during the drying process, which lasts about a week.

If the crops are harvested in this manner it is possible to store the cured bulbs for several months. Collect the wind

rows of onions when the dry tops are covered with dew and are pliable for plaiting or tying into convenient bundles for hanging in the storage barn.

The enormous waste in our Rhodesian onion crop each year is due to growers persisting in allowing the crop to either ripen and dry off in the soil or the fully developed bulbs are lifted with green tops, but the tops are severed and the wet bulbs bagged at once for sending to local markets.

These badly treated onions contain excessive moisture and are easily bruised in the sacks. They arrive at the market or store often in a smelly and rotting condition where they are to be emptied out, dried, re-sorted then sold for what they will fetch. This faulty harvesting has given the locally grown onion a bad name, and it is quite usual to refer to all half rotten onions as Rhodesian, even if they happen to come from beyond our borders. Good onions on the other hand are nearly always sold as Cape grown, even if they have been produced in the Colony. This very unsatisfactory condition may easily be avoided by harvesting the local product as suggested. These well cured onions will store for several months with safety if they are hung in a suitable storage place. The improved keeping properties will extend our marketing season appreciably and it will not become necessary to import large quantities of dry onions from other sources.

Stored onions often commence to grow when the autumn weather is cooling off. These bulbs should be planted in the garden where they will multiply and furnish an excellent supply of green or spring onions. These and the dry product will supply the home throughout the year. Other supplies of green or bulbless onions may be produced from seed sown at any other season of the year.

Parsnip.—Give the same treatment as that suggested for carrots. The seed soon loses its germinative properties. A very small test planting should first be made to ascertain if the seed is good. Freshly collected seed need only be planted thinly, otherwise thinning will be necessary. February-May is the only planting period recommended. "Hollow Crown," "Student" and "Guernsey" are all good varieties.

Peas.—One of the most popular vegetables but the small yields often exclude the crop from very small gardens. One hundred feet of rows per month from February to August should provide an adequate supply for most homes. Dwarf and semi-dwarf varieties are recommended. Over-ripe pods may be left to mature and furnish a seed supply for later

Wiehahns Crescent is the most promising variety for general planting. Peter Pan is a very useful dwarf variety, and Yorkshire Hero a good large sweet marrowfat variety.

Pumpkin.—Not too popular with home-born residents but an invaluable food for infants. Early planted crops often escape the attacks of melon fly. Also late under-planted crops in mealie lands. In garden practice it is usual to manure hills spaces 6 by 6 feet apart very liberally with well rotted manure or compost and plant six seeds to each hill. Thin later to three plants. Ceylon or Gooseneck is as good as any variety for quality and high yields. Boer Pumpkin is popular with South Africans. If melon fly are troublesome treat with the fly bait recommended by the Entomological Division.

Radish.—Easily grown as a companion crop between most other plants. A six foot row planted every month will be ample for the home. Icicle is a nice hot sort. French Breakfast the favourite, and Turnip Rooted useful if others are unprocurable.

Spinach.—The first choice for every garden. Easily and quickly grown. Possesses most mineral salts. There are many varieties; many people dislike spinach but this may be overcome by adopting a better method of preparation for the table. If the leaves are thoroughly washed to remove the grit and then steamed and flavoured with a little salt, pepper and butter it is quite a delightful vegetable. Swiss Chard or Spinach Beet is the most planted variety and possibly the more popular with consumers. Sow in seed beds in early spring or autumn and transplant when three inches in height. A twenty foot row recommended. May be sown *in situ*, but is a little wasteful with seed. New Zealand is also a good sort for planting in this Colony.

Tomato.—This vegetable is indispensable in the home garden; it is of particular importance owing to its valuable vitamin content. No vegetables equal tomatoes for usefulness; they are eaten raw, cooked or converted into jams, juices and other preserves. In frost free areas crops may be grown throughout the year, but disease control for blights and mildew, etc., is essential during the wet season. Seed planting may be made in boxes or seed beds and the seedling plants set out when they are three inches high. The crop is not particular in regard to its soil requirements; it does well on most types. The usual planting periods in the areas subject to light frosts are:—July to October, and with some varieties January to March, this latter planting often requires protection from cold with grass or other suitable screens or mats.

Crop rotation is necessary. Tomatoes should on no account be planted on the same soil two seasons in succession; they should not follow a crop of potatoes, since both belong to the solanaceous group of plants and are therefore subject to many pests and diseases affecting the group. *Remove all plants after the crop has been harvested and destroy rather than place in the compost pit or stack.* This precaution is suggested, since there is danger of spreading disease throughout the garden. Most diseases are destroyed by the high temperatures generated during the decomposition of the compost stack, but the risk is not worth the small amount of compost produced from diseased material. All plants should be tied to suitable stakes made from saplings, reeds or other suitable supports. Tying may be done with any available material, but raffia is usually cheap and is best for this purpose. One to three stems per plant are recommended, all side shoots should be removed when they are still small otherwise a lot of energy is wasted that would normally go to fruit or necessary plant growth. Where the plants are set 3 by 3 feet apart it is a good practice to draw the tops of four supports together and tie; these miniature wigwams will not blow over and the weight of the fruit will then hang in the shade formed by the tied tops and little or no damage result from both sun scald or cold injury. This crop is normally drought resistant; over-watering is harmful, it aggravates most leaf diseases. A good watering once a fortnight is better than a daily sprinkling. Extra dressings of phosphatic fertilisers are ample with this crop. Superphosphate or bonemeal at the rate of one to two ounces per plant forked in to the soil before planting will be helpful. Varieties found to be suitable for planting in the Colony are:—Earliana, Marglobe, Beauty, Bonny Best, All Best and Best of All. A highly disease resistant, small preserving variety has been developed by the writer and is now being grown under the temporary name of "Puree," since it is eminently suited for the production of most tomato products. This selection stands very adverse conditions and will fruit heavily in most areas, no pruning or supporting being necessary. A few plants set in sheltered or odd corners will often produce fruit throughout the winter if the seed is planted during March. Seed of this selection may be available for issue in small quantities next planting season.

Turnip.—Not always a success. It is affected by many pests, but an occasional planting of a 10 ft. row is suggested. Turnips are usually regarded as a winter crop, but excellent roots are sometimes obtained from seed sown in August. March sown seed is satisfactory provided the Bagrada bug is

not permitted to ruin the crop. This pest becomes troublesome when the cool weather commences. No special choice of variety, but American Purple Top appears to be reliable. Early Strap Leaf and Early Snowball are useful quick matures. Remove all turnips, refuse and unharvested roots when the crop is over, since if left in the bed they will soon breed a host of Bagrada trouble.

Vegetable Marrow.—Same treatment as that recommended for pumpkin.

Cricket Ball is a nice runner type. Long White and Long Green Bush marrows are very useful for supplying bulk. Seed should be sown from July onward. Affected by melon fly also mildew, but these may be treated by baiting and spraying.

Cucumbers.—A few seeds planted in July and treated as suggested for marrows may be included in the garden. Cool and Crisp is a popular sort.

Watering.—The general practice of watering the vegetable garden with small amounts of water both morning and evening should be discouraged. A good soaking, say, once a week will do more good. The frequent sprinkling produces a shallow root system and most of the added moisture is lost by evaporation. Wilted foliage is the principal way of ascertaining whether the plants require water or not. This condition is easily seen when walking through the garden first thing in the morning. If the plants are commencing to show signs of distress then it is time to water them. Wilted foliage seen in the afternoon is of little account, as most plants wilt and thereby regulate the transpiration of moisture in accordance with that absorbed by the roots. These wilted plants soon revive of an evening. No hard and fast rule may be given regarding the amount of water required by most plants, but it can be safely stated that the most economical application will be the outcome of studying the wilting factor. In most gardens irrigation is necessary every seven days in winter and every five days in summer. These applications to be about one inch in depth over the entire surface of the bed. In calculating the amount of water to apply with the watering can, I find 4¾ gallons of water applied to the square yard of soil will equal a one inch watering. A 30 ft. by 4 ft. 6 in. bed will equal 15 square yards, and if 24 three-gallon cans full of water is applied to this area once a week it will do considerably more good than the usual 4 three-gallon cans full per day. Watering through the hose pipe may also be calculated in the same manner. A tap giving 12 gallons per minute at the discharge

end of the hose pipe should be kept running on the same sized bed for six minutes. Over watering is possibly more harmful than under watering; if success is desired sufficient attention should be given to the water requirements of the plants. Overhead sprinklers are ideal for watering the garden, but the first cost is high, and as no piping is available other than at considerable cost, it need not be considered now.

Mulching and Cultivation.—Mulch all beds with a light layer of long grass as they are planted. This may in some cases be retained throughout the life of the plants, but it is usually advisable to thin the mulch immediately over the rows as the seedlings appear. The mulch prevents baking of the soil from heavy rains. It also helps to keep the soil cool during hot weather. Furthermore, it prevents undue loss of added moisture by evaporation. The mulch gradually rots down and is incorporated in the soil during subsequent digging operations. Renew the mulch from time to time if the white ants persist in eating it. This trouble might be reduced or cured by spraying the mulch with arsenate of lead to poison the pests (2 ozs. to 4 gallons water). Cultivation is less important than mulching, but it is often necessary for removing weed growths or breaking up any soil crusts that have formed after irrigation or other cause. The three-pronged cultivator hoe is one of the best garden tools for this work, but it should be used when the weeds are small. The planters' hoe is the next choice, being excellent for all soil loosening operations.

Shelter.—As most gardens are suitably protected it is only necessary to suggest that grass fences or screens are easily erected on the windward side of the site planted to vegetables. A thin screen of very tall grass has served the writer well for the last five years or sufficiently long to enable the slow growing Cypress trees to become effective. Thick layers of grass soon rot during wet seasons.

Companion Cropping.—Reference has already been made to the advisability of planting quick maturing crops between the slower ones. This practice is strongly advocated in all gardens. It is both economical and profitable. An outstanding example of companion cropping is that of planting a crop of beans for dry or green beans in the potato section that has matured in January or February. If the potatoes are left in the soil there is danger of the tubers rotting, but not so if beans are there to remove the excessive moisture responsible for the potato rot. If more of this type of companion cropping were practised it would materially relieve the potato glut that often occurs during the January-

March period, when unnecessarily large quantities of potatoes are often sacrificed at low values.

Transplanting.—A little advice on this operation has already been given under a few of the vegetable crops dealt with, but it is often not possible to choose the ideal weather (dull or overcast) for this work. If transplants are set out during windy, dry or hot periods, as is sometimes done, there is often a heavy loss of plants due to drying out during or after the planting out process. This loss may be prevented to a considerable extent by the following treatments:—

(*a*) Remove up to three-quarters of the plant foliage before lifting from the seed bed. This helps to reduce loss of moisture through the foliage (transpiration) and the transplants are better able to re-establish themselves in their new situations.

(*b*) Protect the more delicate transplants with temporary shade which may either be grass, hessian or tobacco seed bed cloth, or just a twig from a leafy tree. If the twig is inserted in the soil on the western side of the newly set plant it will help shade it from the afternoon sun, also reduce loss of moisture through evaporation.

(*c*) Transplant of an evening if possible, and water immediately after planting to settle the soil surrounding the roots of the plants.

(*d*) Water the seed beds or boxes a few hours before lifting the plants. This often enables one to lift the plants with a small ball of earth attached to the roots. This reduces root injury and the transplants seldom suffer unduly after they are moved.

Rotation.—It is not advisable to plant similar types of crops in the same soil year after year. This does not apply to perennial crops like asparagus and rhubarb. Root crops should not follow root crops, since they deplete the soil of root forming plant food elements sooner than where plants of different groups are rotated. The main groups to be considered in the average garden are:—

(1) *Root crops.*—Carrots, parsnips, beetroot, onions, leek.
(2) *Cuciferous.*—Cabbage, cauliflower, brussels sprouts, turnips, mustard, broccoli and kale.
(3) *Solanaceous.*—Potato, tomato, egg fruit.
(4) *Cucurbits.*—Pumpkin, marrow, cucumber, melons.
(5) *Legumes.*—Beans, peas.
(6) *Miscellaneous.*—Lettuce.

A useful rotation would be:—Cuciferous, root, legume, cucurbit, solanaceous.

How to Prevent Waste.

HINTS ON THE CONTROL OF DISEASES AND PESTS.

By J. C. F. Hopkins, D.Sc. (Lond.), A.I.C.T.A., and
A. Cuthbertson, F.R.E.S.

There are many ways of increasing production of foodstuffs, but the most economical of all is by preventing waste. This is particularly applicable to vegetable growing, for waste can so easily occur through oversight or slight carelessness. Cleanliness and method are essential for successful control of diseases and pests, and prevention is better than cure.

Vegetable growing is the most intensive form of agriculture, for a great deal of produce of high value is packed into a very small area. The losses which can be brought about by a disease or pest are therefore proportionately high. Once a pest or disease finds it way into the vegetable garden, it is impossible to get away from it except by moving the site of the garden or ceasing to grow crops, but it is possible to control the trouble. It is the invariable experience of vegetable growers that their crops are free from pests to start with, but that their troubles increase progressively as time passes. This is because little or no effort is made at present by Rhodesian growers to protect their vegetables from blights and insects and many gardens are run in a haphazard manner.

One of the chief faults to be found almost everywhere is the habit of leaving old plant refuse lying about for days after a crop is finished. A variation of this is leaving a whole plot lying idle and full of diseased plants, breeding insects by the thousand, waiting for a few backward plants to mature. Not only is trouble being manufactured at a high speed, but a valuable piece of land is kept out of cultivation, often for weeks on end, merely for the sake of a few shillings worth of produce. In any case, the chances are high that the backward plants will never come to anything because they are probably infected with virus diseases. This is particularly the case with cabbages, cauliflowers, turnips, tomatoes and cucumbers. Most vegetables will go on cropping for months in Rhodesia, but it is asking for trouble to leave them in the garden after they have passed the stage of maximum production. Have them out and put the plot down to a new rotation.

Cabbages, for example, should all be harvested, the stalks put in the compost pit and the leaves turned under the soil within a week of the majority of heads ripening. No method of disease or pest prevention can be efficiently put into practice unless elementary rules of plant hygiene are observed. The first essentials for successful vegetable production are cleanliness and method.

Weeds, too, bring diseases and pests. Not only are they detrimental to plant growth, but many of them harbour serious viruses, although they may not show it. They also attract insects, such as the aphids, which spread viruses, and cutworm moths.

The next requirements are rapid and vigorous growth, which can be effected by the methods advocated in the first part of this article. It is, however, an unfortunate fact that, despite every care being taken in cultivation, diseases and pests will attack growing crops, and it is because of this that other control measures are necessary. In the main, these are disinfection of seed, followed by spraying the plants with substances to kill insects and the fungi and bacteria which cause disease. As far as possible a combined insecticidal and fungicidal spray should be used so that the work can be done in one operation and so save labour. A summarised table of the chief diseases and pests of the more common vegetables is given at the end of this article.

Now, the employment of regular spray schedules is more or less a new idea to Rhodesian vegetable gardeners, although in other parts of the world such procedure is regarded in the same light as ploughing and cultivating—a matter of normal routine. But if undue waste is to be avoided—and it must be avoided—regular and intelligent use of spray schedules will have to be adopted. Some people quibble at the cost and fancifully believe that spraying is uneconomic. Such ideas can only be born of lack of experience or ignorance of correct procedure. Take potatoes as an example. This year many crops have been seriously reduced in yield by early blight, which killed the shaws before the tubers had filled out. It is not unusual for yields to be reduced by a third under such conditions. Now spraying the crop three times gives good control of early blight and the cost is handsomely repaid by the increased yield. The cost of spraying an acre three times with a suitable fungicide is about 18s., plus labour charges. Such a precaution may quite easily raise a 60 bag crop to 90 bags per acre. At present prices this represents an increased cash return of over £30 per acre.

Similar examples can be found with many other vegetable crops. How, then, can spraying be uneconomic?

Bare Fallow.—Beds which are heavily infested with eelworm should be cleared of weeds and crop remains and frequently hoed over in order to dry out the soil as much as possible; the curative powers of air and sunshine cannot be over-estimated in this connection.

Seed Treatment.—A large number of diseases of vegetables are carried over from one season to the next on seed. In fact, it is highly possible that the majority of diseases affecting all crops in Rhodesia have been imported with the seed at some time or other. Modern science has devised simple means of disinfecting seed at small cost, and it is fortunate that there are good supplies of suitable preparations in the Colony at present. For the vegetable grower the most satisfactory and easily used disinfectants are proprietary dusts containing mercury compounds. There are three brands now on the market, namely, "Agrosan G.," "Ceresan New" and "Harvesan." Manufacturers' instructions are printed on the containers, but these usually refer to the treatment of seed in bulk. For the vegetable grower who buys his seed in small quantities a simple method is to place small seeds in a screw-topped fruit jar, add 1/10th oz. of the dust per pound of seed, screw the top on firmly and shake for a few minutes until each seed is evenly coated with the disinfectant. The surplus dust, if any, should be winnowed off in the open air and care taken not to inhale any, as it is highly poisonous. *All utensils used should be well washed before they are put away and care should be taken to see that no dust remains on the hands. The disinfectant should be stored out of reach of children, natives and animals.* If seed is bought in small packets, enough to cover the tip of a teaspoon should be placed in the envelope, the whole shaken for a few minutes and the surplus dust winnowed off as before

USEFUL SPRAY MATERIALS.

There are proprietary brands of spray materials to suit all requirements of the vegetable grower marketed locally. Manufacturer's directions are on each packet. They can be classified under the following headings:—

Copper (mainly for leaf blight).

Dry Bordeaux, Ky-Bordeaux, Perenox, Bouisol, Coppesan.

Sulphur (mildew, thrips, mites, fruit tree wash).

Special Sulphuring Dust, Vine Sulphur, Sulsol, Capoidal Insecticide, Lime-sulphur.

Arsenic or Fluorine (leaf-eating insects, cutworms, caterpillars).

Arsenate of Lead, Paris Green, Flosol, Barium fluosilicate.

Mercury (seed potato dip, seed disinfectants).

Aretan (dip), Agrosan G., Ceresan New, Harvesan.

Nicotine (aphids, sap-sucking insects).

Tobacco Extract 40% and 7%.

Spreaders (to make sprays spread and stick).

Capex Universal, Lethalate, Boot's Wetting Preparation.

A combined spray suitable for the control of most insects and plant diseases contains copper, arsenic, nicotine and a spreader. Some people prefer to make up their own Bordeaux mixture and tobacco wash, the following being the correct methods.

Home-made Bordeaux Mixture.

Copper sulphate crystals (bluestone) ...	4 lbs.
Quicklime ...	4 lbs.
Water ...	40 gallons.

Spreader according to manufacturer's directions.

Dissolve the bluestone by crushing in a piece of hessian and suspending in 20 gallons of water in a drum previously painted inside with a bitumen compound. Slake the quicklime by sprinkling with water until a good heat is generated and steam is given off. Add enough water to complete the slaking, but do not allow the lime to become wet. When ready, add the slaked lime to 20 gallons of water in another drum and stir well. Cover with a sack and allow to stand for one hour. Pour the lime water through a double cheese cloth strainer into the bluestone solution, stirring at the same time, then add the spreader. The Bordeaux is now ready for use. It should be applied at once and any remaining over should be discarded, as damage to plants is likely to follow the use of old solutions.

Home-made Tobacco Wash.

A home-made tobacco wash (which should not be mixed with Bordeaux mixture or other sprays containing copper) can be made by soaking 10 lbs. of loose Virginia flue-cured leaf in 20 gallons of cold water for 24 hours, with occasional prodding or stirring. About 16 or 17 gallons of the liquid can be recovered, and should be strained through a muslin cloth or similar strainer in order to free it of particles that might foul the nozzle of the spray pump. The liquid should be made up to 20 gallons by the addition of soap solution of such strength that there will be one pound of soap in 20 gallons of the spray. In practice one pound of soap should be cut up into thin flakes and dissolved in the amount of

boiling water (say, three or four gallons) necessary to add to the liquid recovered from the soaking tobacco to make 20 gallons. If this spray can be used whilst it is still warm, so much the better, but it should in any case be used on the same day on which it is made.

In a spray of this kind, diseases that may be present in the tobacco may be communicated to related plants such as potatoes, tomatoes, egg-plants, etc. If a home-made nicotine spray is required for such plants, or if the 24 hour delay in making the cold infusion is inconvenient, the wash can be made by placing the tobacco in boiling water and allowing the mixture to *simmer* for an hour instead of soaking cold for a day. A certain amount of nicotine is lost by this method and the liquid recovered may not be more than 13 or 14 gallons. In the hot method, therefore, this should not be brought up to 20 gallons, and only 10 to 12 ounces of soap need be added. This can be dissolved in a gallon or so of boiling water removed from the 20 gallons before the tobacco is added.

Where tobacco other than cured Virginia leaf is to be used, the quantities for 20 gallons of water should be varied as follows:—

Virginia flue-cured trash and clean sweepings, 20 lbs.

Fire-cured leaf, 5 lbs.

Fire-cured trash and clean sweepings, 10 lbs.

If there is any suspicion that the nicotine content of the tobacco is below the normal for Rhodesian grown tobacco, the quantity of tobacco should be increased. An overdose will not harm the plants, and may effect a better kill.

Care should be taken that tobacco kept for the making of sprays, or for any other purpose, does not become infested with pests in contravention of the regulations framed under the Tobacco Pest Suppression Act.

Further information is available in Bulletin No. 1060, obtainable from the Secretary, Department of Agriculture, Salisbury, at 3d. per copy.

Poison Bait for Fruit Fly.

Arsenate of lead	1½ oz.
Sugar	2 lb.
Water	4 gallons.

Apply bait in droplets (on the leaves here and there) and on foliage of surroundings plants, such as hedges. Begin when fruits "set" and continue at 10 day intervals. An ordinary garden syringe is useful for this work.

SPRAY SCHEDULE.

CROP	DISEASE OR PEST	NATURE OF INJURY	CONTROL MEASURES	REMARKS
BEANS (bush type)	Stem maggot (adult, small black fly)	Maggot tunnels in leaves and bores downward in stems	Destroy infested plants after picking beans green; destroy all crop refuse after final harvest	Black Wonder and other similar modern varieties resist attack, if vigorous growth obtained
	Bacterial Blight	Yellow blotches and rot of leaves and pods	Plant Resistant Varieties	Black Wonder, Victory
	Anthracnose	Circular brown spots on pods and rot of seed		
	Mosaic	Mottling and yellowing of leaves. Stunted growth, early death	Remove infected plants early Take seed from healthy plants only	Seed-borne virus spread by aphids
BEANS (runner and bush type)	Stem weevil (adult, striped snouted beetle)	Galls in stems made by grub	As for stem maggot; also collect and destroy beetles	As for stem maggot
	Rust	Red powdery pustles on underside of leaf Defoliation	Plant resistant varieties	Runner types usually susceptible
BEETROOT	Nematode	See Turnip		
	Leaf Spot	White and brown spots on leaves	Bordeaux mixture spray, if required Seed treatment	Only necessary if Swiss Chard is grown in wet season
CABBAGE and CAULIFLOWER	Aphids or plant lice	Convey mosaic disease	Tobacco extract spray or tobacco wash plus soap at weekly intervals in seed beds and up to time of hearting Add Arsenate of lead if necessary (see next pest)	Destroy weeds near beds. These harbour viruses

CROP	DISEASE OR PEST	NATURE OF INJURY	CONTROL MEASURES	REMARKS
CABBAGE and CAULIFLOWER (Continued)	Caterpillar	Holes in leaves, or under surfaces eaten in patches	Arsenate of lead Rotations	Remove and destroy all old leaves, stumps and unthrifty plants
	Bagrada bug (small variegated stink-bug)	Withering and poor growth	No effective insecticide known. Pyrethrum dust and a pyrethrum-oil emulsion promising	Bagrada bugs also breed among alyssum, nasturtiums, stock and other garden flowers
	Cutworms	Cut stem at or near soil level	Hand collecting Poison bait not suitable for gardens	Clear away weeds to which moths are attracted to lay eggs
	Black Rot	Yellow "halo" on leaves, blackening of veins and rotting of head	Seed treatment Rotations	(See Rhodesia Agricultural Journal Bulletin 1162, September 1940)
	Mosaic	Stunting, malformation of leaves and heads Small "woody" heads Rotting of leaves and heads	Protect from aphis infestation Remove affected plants early	Due to infectious virus spread by aphids Main cause of crop failure
CARROT	Aphids or plant lice	Infest bases of leaves at soil level. Set up rot in top of root Spread virus diseases	Tobacco wash plus soap applied with force	Mainly in dry season
	Leaf Blight	Foliage turns black and rots	Bordeaux mixture	Very wet weather only
	Mosaic	Yellowing of foliage and stunting	Protect from aphids	Don't plant near celery
CELERY	Blight	Brown spots, yellowing and collapse of leaves. Rotting of stems	Seed disinfection Bordeaux mixture spray in seed-beds	Spray only necessary in wet weather
	Mosaic	Yellow mottling of leaves and stunted growth	Remove infected plants early Control aphids	Virus spread by aphids Don't plant near carrots

CROP	DISEASE OR PEST	NATURE OF INJURY	CONTROL MEASURES	REMARKS
CUCUMBER	Fruit Fly	Maggots in fruits	See pumpkin	Remove and destroy stung fruits
	Bacterial Blight	White, angular leaf spots, wet rot of fruits with exudation of moisture	Seed treatment Rotations	
	Mildew	White powdery coating on leaves	Dust with sulphur Remove vines when main crop has been harvested	Old plants very susceptible
	Mosaic	Mottling of leaves. Stunted growth. Malformed fruits	Remove infected plants early. Destroy weeds in vicinity, especially gooseberry and false gooseberry (*Physalis*)	Don't plant near Easter lilies. Virus spread by aphids
EGG PLANT	Aphids	Twisting and withering of leaves	Tobacco Extract spray	Not serious. Remove and destroy plants no longer wanted
	Anthracnose	Soft brown rot of fruits	Bordeaux spray fortnightly from time first fruits are formed. Destroy diseased fruits	Wet weather only
LETTUCE	Head Rot	Head turns black and rots	Light shade in hot weather. Cut down overhead watering	Due to sunscald
	Mosaic	Mottling and distortion of leaves. Brown spots on veins and leaf margins. Defective hearts. Stunted growth.	Remove affected plants early. Control aphids in seed beds by Tobacco Extract spray. Destroy groundsel, thistle, and Wandering Jew weeds in vicinity Plant resistant varieties	Disease seed-borne and spread by aphids Iceberg variety resistant Don't plant near peas or sweet peas
MARROW	Fruit Fly	See pumpkins		
MELON	Mildew	" "		

CROP	DISEASE OR PEST	NATURE OF INJURY	CONTROL MEASURES	REMARKS
ONION	Thrips	Silvery sheen on leaves. Poor growth	Spraying not very effiacious. Seed beds can be forcefully sprayed with tobacco wash plus soap or lime-sulphur	Plant far away from previous onion bed. Destroy plant refuse after harvest
PARSNIPS	Nematode or eelworm	See turnips		
PEAS	Mildew	White powdery covering on leaves. Growth retarded. Poor crop	Plant resistant varieties	Improved Black Eyed Susan, in hot weather
	Mosaic	Mottling and distortion of leaves. Plants dry up	Remove and destroy crop if severe. Take seed from healthy plants only. Control aphids	No economic return if serious. Disease seed-borne and spread by aphids
	Seedling Blight	Young plants die. Seed rots in ground	Seed treatment	
POTATO	Ladybird beetles and grubs	Reduce leaves to lace-like texture, feeding on underside	Hand collect if infestation light; otherwise use arsenate of lead spray	Can mix with Bordeaux mixture
		All diseases (see Rhodesia Agricultural Journal Bulletin No. 1188, December 1941).		
PUMPKIN	Fruit fly	Fruits are "stung" and maggots set up fruit rot	Apply poison bait (see formula in text) in droplets on foliage and on other plants nearby at 10 day intervals from setting of fruit. Collect and destroy "stung" fruit immediately	"Stung" fruit should be buried or boiled, or left in water with film of oil on surface, or buried deeply with firm covering of soil.
	Mildew	White powdery coating on leaves. Leaves wither	Dust with sulphur if necessary	Don't leave old plants in the bed
SWISS CHARD	Leaf Blight	Brown spots and leaf scorch	Bordeaux spray in seed beds and on young plants. Seed treatment	Only necessary in wet weather. Don't plant near beetroot

CROP	DISEASE OR PEST	NATURE OF INJURY	CONTROL MEASURES	REMARKS
TOMATO	Mites	White coating on leaves and growing shoots, resembling mildew	Lime-sulphur. Avoid close planting and dense foliage	Start spraying when plants 4in. to 6in. high. Destroy badly infested old plants
		Distortion of affected parts and withering		
	Nematode	See turnip		
	Leaf Blight	Brown and white spots, leaves turn yellow and shrivel. Fruit affected by sunscald	Bordeaux, Perenox, or Bouisol from time first buds appear	Thin out foliage. Weekly spraying in wet weather
	Bunchy Top	Plant stunted and leaves bunched at top	Remove infected plants early. Wash hands with soap and water frequently when transplanting and suckering	Plant sap contains infectious virus. Spread by handling
	Blossom-end Rot	Dark brown patch at blossom-end of fruit	Improve water-retaining capacity of soil by manuring or liming. Mulch soil in hot dry weather Light shade also helps	Common in October and November. Due to irregular water supply in plant
TURNIP	Aphids	Convey virus diseases. Withering of leaves and poor growth	Spray with combined tobacco extract and arsenate of lead	Spray undersides of leaves
	Leaf-eating Caterpillars and beetles	Holes in leaves	Do not delay harvesting Destroy weeds and crop refuse	
	Mosaic	Leaves "savoyed" and form a rosette. Growth arrested	Control aphids. Remove affected plants early	Don't plant near cabbages or cauliflowers
		Root becomes woody	Promote rapid growth	
	Nematode	Galls and swellings on roots	Bare fallow in dry season, with frequent cultivation. Heavy dressings of compost or well rotted manure. Rotation	No effective economic chemical treatment of soil for gardens Dessication kills nematodes. Manure reduces nematode infestation

Ticks Infesting Domestic Animals in Southern Rhodesia.

By Rupert W. Jack, Chief Entomologist.

Revised. February, 1942.

(*Continued.*)

We have now to deal with the second family of ticks (*Argasidæ*), of which three species claim our attention. Before proceeding, however, it is necessary to point out that the ticks of this family show a more varied life cycle than those of the preceding family, and their feeding habits are in many respects different. These peculiarities will be dealt with under the heading of each species. As already indicated, these ticks are distinguishable from the common cattle ticks and the other members of the *Ixodidæ* by the absence of a horny shield and the fact that the mouth-parts (except in the larvæ) are hidden under the body when the tick is viewed from above.

The Spinose Ear Tick (*Ornithodoros megnini*, Duges.).—This tick was originally described and studied in America and is no doubt an introduction to South Africa. It occurs in parts of the South African Union, but no specimens taken in Southern Rhodesia have as yet reached the writer. It is likely to come to light in the Colony at any time, however, and many specimens suspected of belonging to this species have been forwarded, only to prove to be examples of ear-infecting ticks belonging to the other family.

The name "Spinose Ear Tick" refers to the favourite feeding site of the early stages of the tick, and the short spines that cover the body of the nymph (see Plate II., figs. 3 and 4). These spines are lost in the adult stage.

The larvæ (see Plate II., figs. 1 and 1a) as they hatch from the eggs are six-legged, as is the case with all ticks. They attach themselves to their hosts after the manner of the common ticks and feed to repletion in about five days, swelling greatly in the process (see Plate II., fig. 2). Remaining attached, they moult their skins after an interval and the nymphs appear (see Plate II., fig. 3). These attach themselves again and also feed to repletion, taking from 35 to

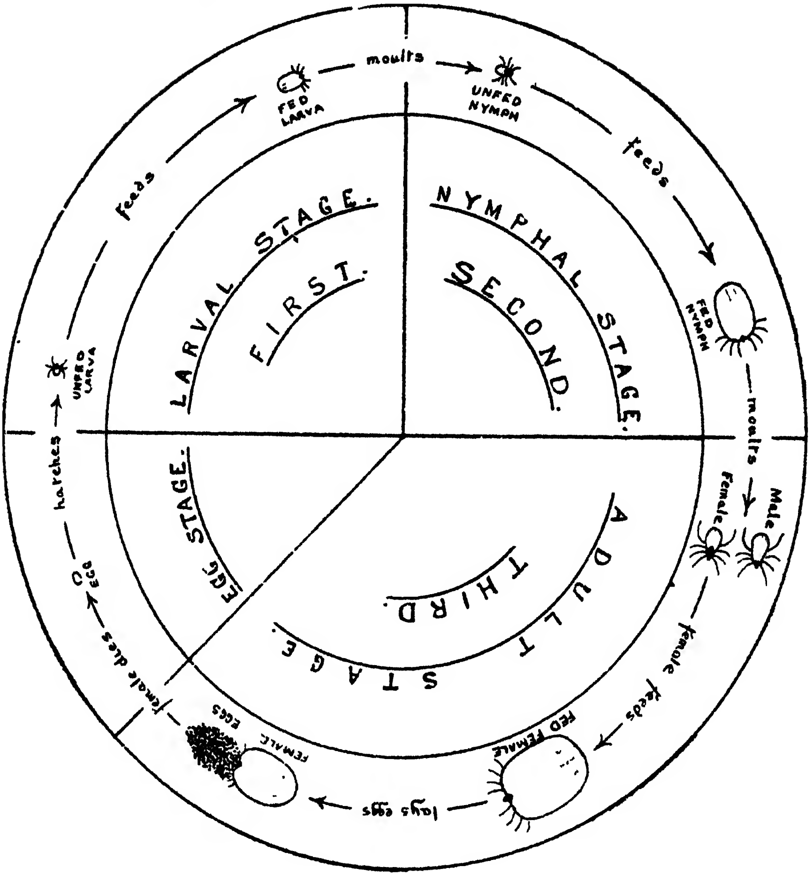


DIAGRAM ILLUSTRATING THE LIFE CYCLE OF A CATTLE TICK.

98 days, and swelling very greatly (see Plate II., fig. 4). It has been stated that the nymphs do not moult during the feeding process, but in a later publication* this is apparently called into question, the idea being that the nymphs moult without leaving the host.' The full-fed nymphs leave the host and "crawl up several feet on posts, trees or the like, and hide in chinks and crevices." The nymphs shed their skins after some seven days in summer, and the adults appear (see Plate II., fig. 5). The adults do not feed, and remain smaller in size than the full-fed nymphs. The eggs are laid in the crevices where the adults live, and the larvæ which hatch out seek a host and recommence the life cycle.

Some recent observations in South Africa indicate that fed nymphs do not necessarily climb to find a crevice in which to moult, but that they, and the adults and larvæ, may be

*"Ticks," by Nuttall, Warburton, Cooper & Robinson. Part II., p. 330.

found in any convenient shelter in a stable or kraal, even if it be on the ground. This species of tick is a denizen of places where animals congregate regularly and may attain great numbers in such localities, but does not infest the open veld to any serious extent. Moreover, it does not appear to thrive much in localities favoured with an abundant rainfall, and would appear more likely to establish itself in the western and southern parts of this Colony than in Mashonaland.

As methods of controlling ticks are to be dealt with later, nothing need be said on this subject here. The Spinose Ear Tick is not known to transmit any specific disease, but its presence in the ear causes great irritation and loss of condition in stock; young animals have been kown to succumb to very heavy infestation.

This species has been found infesting the following hosts: Cattle, sheep, goats, horses, donkeys, dogs, cats, ostriches and man, but it is chiefly a pest of cattle and small stock.

The Tampan (*Ornithodorus moubata*, Murray).—This is the largest of the three species belonging to this family with which we have to deal. It resembles the Spinose Ear Tick more closely than it does the following species, but may be distinguished in the nymphal stages by the absence of spines on the body, and the fact that it does not normally infest the ear, nor remain attached to its host for any length of time. The adults are readily distinguished by the shape, the Spinose Ear Tick adult being "fiddle-shaped," with a strong constriction in the body, while the Tampan adult shows little trace of such a constriction.

The life cycle and habits of the Tampan differ considerably from the preceding species. The larva does not hatch out from the egg, but *moults within*, and the young *nymph* which emerges is the first *active* stage of the tick. The nymphs feed intermittently, remaining hidden in crevices during the day and sallying forth after the manner of a bed-bug to suck the blood of their victims at night. They moult several times in the course of their development, gaining in size and finally reaching the adult stage. The adults, unlike the preceding species, also suck blood freely, and the female is stated to moult her skin repeatedly. The eggs are laid in the chinks and cracks where the ticks congregate, the female laying a small batch after each feed.

The Tampan is best known as a pest of man, transmitting the disease known as African relapsing fever (*Spirochætosis*). It will, however, attack animals when opportunity occurs, and sometimes increases prodigiously in pig sties. It seems

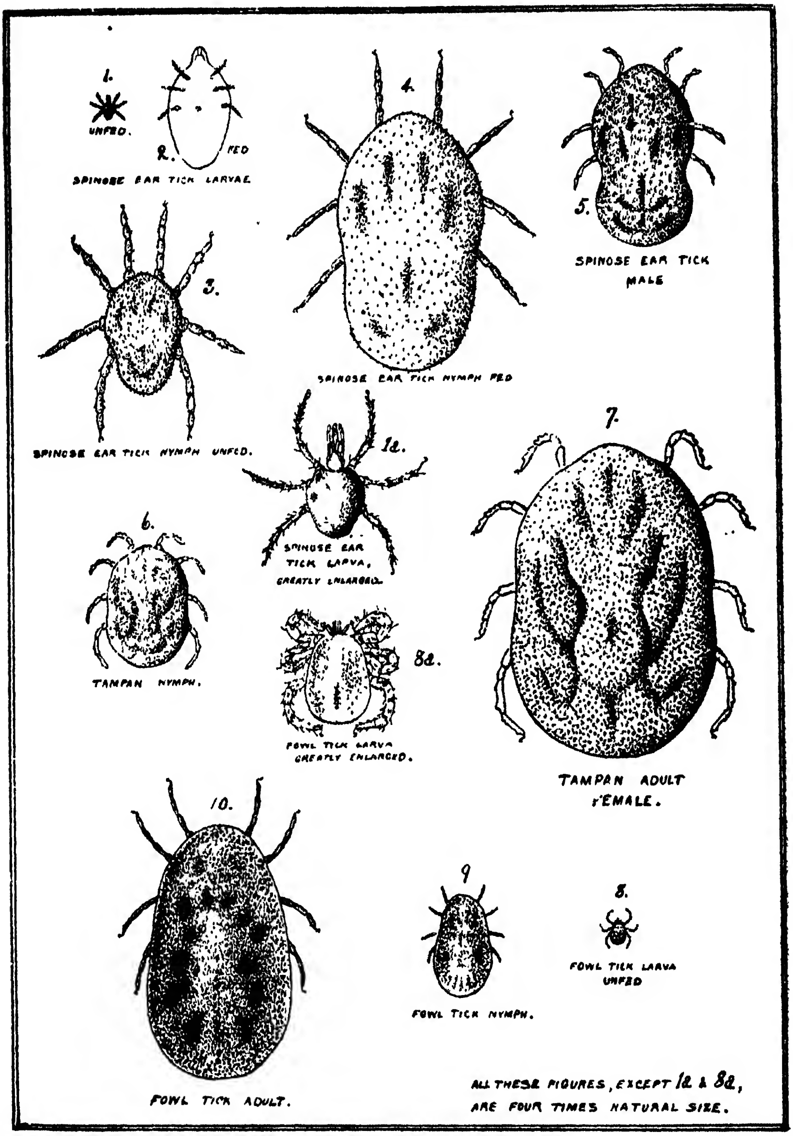


Plate II.

to be common in all parts of the Colony as a pest in native huts, especially perhaps those habitually used by travelling natives. The hosts need not be specified, as the tick will, when hungry, certainly feed on almost any warm-blooded animal, or even bird, that affords it an opportunity.

The transmission of African relapsing fever by the tick has been successfully studied. The female sucks blood containing the organisms, and "the latter pass into the ovaries of the tick and penetrate the undeveloped eggs, where they multiply. They persist in the tick which develops from the

egg and pass out of its mouth-parts when it feeds in the first nymphal stage on a fresh host." The infected tick may harbour the organism and transmit the disease for months, and the organism is stated to be transmitted to the third generation of ticks, even though the second generation feeds on blood free from the organism.

The Fowl Tick (*Argas persicus*, Oken.).– This well known pest of fowl houses in the Colony may be distinguished in the nymphal and adult stages from both the preceding species by the flat back which meets the under surface of the body at a sharp angle, forming a definite edge all round the body. The name "Tampan" is frequently applied to the Fowl Tick, but should be reserved for the preceding species to avoid confusion.

The habits and life cycle are similar to those of the Tampan, with the important exception that the Fowl Tick larva hatches as such from the egg and is an active parasite. It attaches itself to its host and remains for some five to ten days, being commonly found under the wing. When fully engorged this larva is about one-twelfth of an inch in length. It now drops off its host and in about eight days in summer moults its skin and the nymph appears. The habits of the tick are now similar to those of the Tampan, already described. Mr. C. P. Lounsbury, who worked out the life history of this tick at the Cape, reared it from egg stage to the following egg stage in ten months.

The Fowl Tick transmits the fowl disease *Spirochætosis*, which is very prevalent in this Colony. It appears that after a tick has fed on infected blood, the organisms multiply in its body and it is able to infect any susceptible bird it feeds on for six months or more afterwards. The infection is also hereditary for at least two generations. Apart from its power to transmit disease, the tick is a very serious pest on account of direct injury inflicted, and the writer has seen cases in which fowls, introduced to long empty badly infested premises, died of exhaustion within two days.

The tick is stated to be a pest of man in Persia, but in African experience it is pre-eminently a poultry pest, attacking fowls, geese, turkeys, ducks, pigeons and even canary birds.

THE MOUTH PARTS OF TICKS.

It may interest the reader to know something of the structure of the mouth parts of ticks. As is well known, a tick when pulled off an animal or human being frequently

either leaves its "head" behind or brings away a small piece of skin and flesh with it. A study of fig. 16 in Plate I. will indicate why this occurs. The "beak" of the tick which enters the skin (marked "hypostome" in the figure) is armed with a series of backward projecting processes, each one like the barb of a fish hook. It is evident that although this may be pushed comparatively smoothly into the skin, it cannot be pulled out forcibly without something giving way. It is by means of this beak or hypostome that the tick is anchored to its host during the process of blood-sucking. It could not possibly maintain its position during the process of engorgement by the power of its legs alone, as these are, as a matter of fact, comparatively useless to a swollen tick whilst on its host.

The mode of insertion of the barbed beak is also a matter of interest. It is conceivable that a tick might simply push it in whilst maintaining a grip with its highly prehensile feet, but none the less this is probably a mechanical impossibility, because there is an elaborate and rather beautiful contrivance for assisting the passage of the beak into the skin. This contrivance is shown in fig. 15 on Plate I. The under side of the beak alone carries the backward-pointing barbs. On its upper surface lie the modified mandibles, bearing a few outward directed recurved lancets at their extremities. These mandibles are capable of being thrust out beyond the beak and are attached to muscles which admit of their being drawn back strongly until the beak projects well beyond them. The tick, seeking to attach itself to its host, thrusts out the hooked mandibles, and, the portion bearing the hooks at the extremity being movable, commences to cut a hole in the skin, into which the beak is worked. The mandibles continue to cut a way for the beak until the latter is buried up to its base. The palps or feelers do not enter the skin, but are spread apart on the surface as the beak enters.

The fundamental characteristics of the mouth parts are common to all ticks, whichever family they belong to, but there are considerable minor modifications in respect to the length and shape of the hypostome, and the completeness or otherwise of its armament of barbs. Ticks, like the nymphal and adult stages of the Fowl Tick, which feed quickly, have few barbs on their beaks, as they do not require to anchor themselves so firmly as the Ixodid ticks, which feed over a considerable length of time. The adults of the Spinose Ear Tick, which do not feed at all, have reduced mouth parts with an unarmed beak.

METHODS EMPLOYED IN CONTROLLING TICKS.

Cattle Ticks (*Ixodidæ*).—A number of methods have been recommended from time to time in respect to the destruction of the common cattle ticks (family *Ixodidæ*), and probably several of these are still employed in other countries, but as far as South Africa is concerned, dipping in an arsenical solution is almost universally adopted when any considerable number of cattle have to be treated. Spraying is sometimes resorted to in the case of small herds. Before dealing with the subject of dipping, it may be as well, however, to touch briefly on one or two other methods.

(1) *Spraying with Paraffin and Water.*—Paraffin is one of the most potent contact insecticides known and kills ticks very rapidly by contact. It does not do a great deal of harm to animals even if sprayed in the pure state on to their hides, but is, of course, very expensive. It has the disadvantage of not mixing readily with water, and so can only be diluted in a specially constructed pump which mixes the paraffin and water mechanically in the delivery hose pipe. Experiments have shown that the minimum effective strength against ticks is 15 per cent. paraffin in water, and for reliable effect the pump is usually adjusted to 25 per cent., as even the best pumps of this design are uncertain in their delivery. This form of spraying is effective, but troublesome, laborious and very expensive compared with the use of arsenical dips.

(2) *Hand Dressing.*—Smearing the udders of cows and the inside of ears of stock with greasy preparations to destroy ticks which attack these parts and are not readily killed by dipping is of considerable value. Tick greases of this nature are on the market. Crude petroleum is stated to be of value in this connection, as also is a mixture of paraffin oil and paraffin wax, according to a formula designed by Lieut.-Col. Watkins-Pitchford in Natal, *viz.*, paraffin oil, one quart; paraffin wax candles, No. 6, 6 to 8. One quart of paraffin should be *cautiously* warmed in an open vessel and the candles broken in small pieces, dropped into the oil, when they will rapidly dissolve. In hot weather it will be found that eight candles to the quart are necessary to produce a mixture of the required consistency, while during cold weather five or six candles will be found sufficient.

(3) *Burning the Grass.*—This operation is of some value in reducing the number of ticks where it can be carried out and if it be done intelligently. Mid-winter burning is probably least effective, as the ticks are more or less dormant during the cold weather. For the purposes of tick destruction

burning should be carried out after tick life has revived, that is *as late in the season as possible.* October, or even November, if the weather permits, are probably the best months from the tick-killing point of view.

(4) *Starvation.*—Ticks will live for a number of months without feeding, but they are not immortal, and if all animals can be kept away from pastures for a sufficient length of time the ticks present must die out. Conditions in Southern Rhodesia are, however, probably less favourable to the adoption of starvation measures than those in certain other parts of the world owing to the abundance of animal life, such as small buck, hares, jackals, ground vermin, etc., that occur on most farms and cannot be kept out of an ordinary fenced paddock. Elaborate methods based on the life history and known duration of the different feeding stages of ticks have been evolved and applied in the United States of America, but, although the writer has details of these methods before him, it appears unnecessary to deal with them in the present article, as they are quite unlikely to be adopted in this Colony. As a general statement, it has been affirmed that if a piece of land can be kept absolutely free from tick hosts for a period of fifteen months the ticks must be eradicated (Theiler).

(5) *Dipping.*—There is no intention of dealing exhaustively with the subject of dipping in this article, but it is desirable to mention the fundamental principles underlying the practice as at present applied in this Colony.

The active agent of an effective dip against ticks is arsenic in a soluble form. As a matter of fact, arsenite of soda is the chemical almost universally employed in both home-made and proprietary dips. Good results were obtained in the initial experiments in the Cape Colony with a plain solution of this chemical in water, generally employed at that time as a 14-day dip of 1 lb. of 60 per cent. arsenite to 25-30 gallons of water. A plain aqueous solution of 80 per cent. arsenite of soda is still widely used at strength of 1 lb., 2 lbs. or 3 lbs. of the poison to 100 gallons of water, according to whether three-day, five to seven-day, or fourteen-day dipping is intended. There are, however, two alleged drawbacks to the use of the plain solution, namely, that it is inclined to injure the skin of the animal, especially with repeated applications, and that it is slightly deficient in wetting power. It may sound somewhat curious to state that water is deficient in wetting power, but none the less the addition of certain agents diminishes the surface tension of the liquid and presumably causes it to penetrate more thoroughly to the hide of the dipped animal through the hair.

The addition of soap, for instance, has a marked effect in this direction. It is obvious, therefore, that the addition of substances to the arsenite of soda solution which will check the caustic action on the hides of the animals and cause the liquid to wet the animals more thoroughly is an advantage. There is no great difficulty about this, and most proprietary dips have a special formula of their own. The following formulæ are, however, the ones devised by Watkins-Pitchford in Natal for different intervals between the dips, and are generally referred to as the

LABORATORY DIPS.

	3-day.	7-day.	14-day.
Arsenite of soda 80 per cent.	4 lb.	8 lb.	12 lb.
Soft soap	3 lb.	6 lb.	6 lb.
Paraffin	1 gall.	2 galls.	2 galls.
Water	400 galls.	400 galls.	400 galls.

The soap and arsenite should be dissolved separately in a sufficient quantity of hot water; the soap solution should then be added to the paraffin and beaten up into an emulsion; mix both solutions together and add water to make up 400 gallons, stirring vigorously in the meantime.

In parts of the Colony where the Cattle Cleansing Act is in force seven-day dipping is practised. Fourteen-day dipping, although a greater strength of dip is used, is not so effective in eradicating certain ticks as the weaker solution used more frequently. Shorter interval dipping is employed in dealing with outbreaks of East Coast Fever. Seven-day dip strength at five-day intervals is commonly used in dealing with East Coast Fever outbreaks, three-day dipping having not always proved effective. The dipping is supplemented by hand-dressing the depths of the ear, the sheath, anus and brush of the tail.

The reason for the increased effectiveness of the shorter interval dipping against certain ticks lies in the length of time occupied by the various stages in feeding. Ticks with a life cycle of the three host type are less easily eradicated by fourteen-day dipping than those which feed only on one host, for the reason that the immature stages may attach, feed up and fall off again between the dips, whereas the Blue Tick, for instance, which passes through all its stages on the one host and occupies some three weeks or more in the process, must undergo immersion at least once, even at the fourteen-day interval, and would in many instances undergo two. With ticks feeding on three hosts in the course of their

development, of which the Brown Tick may be taken as an example, the larval and nymphal feeding periods are quite short, as stated. The idea of the three-day dip was to ensure that all the larvæ underwent at least one immersion, and, of course, the nymphs and adults as well. Cattle will not, however, endure too frequent dipping at the greater strengths without injury, and the dip needs to be weakened in proportion as the interval is decreased, and owing to the greater susceptiblity of the larval and nymphal stages, they can be destroyed by weaker dips, although at some sacrifice of killing power as regards the adults. As the infection of East Coast Fever is taken up by the larvæ or nymphs, and is not transmitted through the eggs, it is the two early stages of the tick that it is most important should be quickly destroyed in checking an outbreak. Regular dipping at the seven-day interval will eventually eradicate the Brown Tick, but it would take considerably longer to check an outbreak of the disease than five-day dipping.

Ticks which feed well inside the ears, like the Red Tick larvæ and nymphs (and this species is also an agent in transmitting East Coast Fever), are not effectively killed by dips. The same remark applies to ticks which attach to bare parts of the body, as the Red Tick adults do under the tail, or in the brush of the tail, and these must be treated by hand-dressing in fighting an outbreak.

HOW DO ARSENICAL DIPS KILL TICKS?

Compounds of arsenic, as is well known, are largely used as stomach poisons in insecticidal practice, having been found effective against leaf-eating insects, apple codling, and, in fact, any insects whose feeding habits render it possible to place the arsenic in such a position that it is eaten with the natural food or with some artificial food attractive to the insects concerned. As a contact insecticide arsenic has been found in agricultural and horticultural practice to have little value. Compounds of arsenic used for application to plants are, however, practically insoluble in water, because the soluble compounds are deadly to plant life. Arsenite of soda, which forms the basis of arsenical cattle dips, is completely soluble in water, and undoubtedly has considerable action as a contact insecticide. The writer recalls some experiments carried out many years ago in Cape Town under the direction of Mr. C. P. Lounsbury, in which engorged female blue ticks were taken from an unsprayed animal and place in contact in the dishes, used for rearing ticks at the time, with hair cut from an animal recently sprayed with arsenite of soda

solution, the hair being cut after drying. These ticks behaved very much as ticks taken from a sprayed animal, either dying without laying eggs, or, if a few eggs were laid, these usually failed to hatch. A very few larvæ occasionally hatched. In this case it was obvious that the poison was absorbed through the skin of the tick. The reduced effect of arsenical dips on ticks which attach to bare places on the host also indicates that contact with hair coated with arsenic is a factor in bringing about the destruction of these parasites.

It has, however, been shown that regular dipping results in the tissues immediately underlying the skin of animals becoming impregnated with arsenic. This is stated to be a condition which is gradually acquired, the system becoming accustomed, with the continuance of dipping, to hold the arsenic without detriment to the animal. The storage of arsenic in these tissues does not go beyond a certain point, and the poison is rapidly eliminated if dipping is discontinued. The arsenic in these tissues is sufficient under conditions of regular and short-interval dipping, as was first shown by Lounsbury at the Cape in 1904, to kill a certain percentage of the ticks, especially larval ticks, which attach, even if they have not been through the dip, and also apparently to prevent some proportion of ticks from attaching at all. It appears, therefore, that arsenical dips act also as a stomach poison on ticks, and that enough may be taken in through the mouth parts from a regularly dipped animal to cause death.

CONTROL OF TICKS OF THE FAMILY ARGASIDAE.

Spinose Ear Tick.—This tick, owing to its retreat far inside the ear, does not yield to ordinary arsenical dipping. The ears of the infested animals need to be dressed by hand. There are proprietary dressings for this purpose on the market. The late Mr. G. A. H. Bedford, Entomologist, Division of Veterinary Research, South African Union, recommends the following:—"Two parts each Stockholm tar and oil to one part turpentine. Sweet oil was always recommended formerly, but cheaper oils have been found to be equally effective." From a teaspoonful to a tablespoonful should be poured into each ear according to the size of the animal. On badly infested farms it may be necessary to treat animals every two or three weeks, in exceptional cases once a week, otherwise treatment at monthly intervals is sufficient.

Permanent kraals, especially those built of loose stones or bricks, should be avoided. Wire kraals are best, and the

position should be shifted as soon as the ticks show a sign of increase. Brushwood packed along the fence will afford shelter to the animals, and should be fired after the wire has been removed. For permanent kraals and cattle sheds good brick work plastered over so as to afford no lurking place for the ticks is desirable.

It need hardly be said that cattle introduced from the South African Union, especially from a known Spinose Ear Tick area, should be hand-dressed carefully to avoid the risk of introducing the tick to Rhodesian farms.

Tampan.—As this tick leads an independent life from first to last, taking only a space of time measured by minutes over its feeding operations, it is not possible to control it by any treatment of its hosts. The seclusion of its diurnal retreats further renders its destruction a very difficult matter indeed. As a human pest in native huts of an ephemeral form of construction the situation is best met by burning the whole structure down and building anew elsewhere. To avoid being bitten by this pest and so running the risk of contracting relapsing fever, any spots regularly frequented by natives should be avoided, particularly native huts and sandy spots where travelling natives regularly camp. The instance of the infested pig-sties already mentioned constituted a practically hopeless case. The tick can, of course, be destroyed by heat, but large numbers invariably escape the most thorough firing if the stone or brick walls afford sufficiently deep hiding places, as such walls almost invariably do. Plastering or tarring over the surfaces of the walls and so imprisoning the ticks is practicable in certain cases. In building permanent pig-sties the walls should certainly be constructed so as to afford as little shelter for the ticks as possible. Brick walls covered with cement and cement floors are almost ideal as far as cleanliness and parasite control are concerned. These ticks are probably largely spread in the bedding and clothing of natives, and a single fed female, dropped in favourable surroundings, may be the means of gradually infesting an extensive building in a gross degree.

The Fowl Tick.—The fowl tick is usually brought to new premises by means of birds infested with the larvæ, which, as already stated, remain attached to their hosts for 5 to 10 days. Introduction of fresh birds, therefore, calls for certain precautions. The birds before being introduced into the runs should, in fact, be kept in quarantine for a sufficient period to ensure that any attached tick larvæ will have completed their feeding and fallen off; that is for 10 days.

There are two points to be observed with reference to the quarantine. Firstly, the site should be well removed from the fowl runs. Secondly, arrangements need to be made to ensure that no larval ticks falling from the birds will escape to infest the premises. It is hardly necessary to emphasise a third point, namely, that the place of quarantine must itself be free from tick infestation.

The safest and easiest procedure appears to be to use crates of ephemeral construction for confining the birds during quarantine and to place them in the middle of a quantity of dry grass, in such a position that the grass and crates can be burnt *in situ* after removal of the birds.

Quarantine as above should also be practised in respect to all birds if and when their normal quarters are being freed from tick infestation.

Eradication of the fowl tick from fowl houses is a difficult matter and any measures adopted need to be applied very thoroughly. Only well built houses are worth attempting to clean up. Roughly constructed—*e.g.*, pole and grass—houses should be burnt, if they become infested.

The preparation most generally recommended for killing these ticks by contact, is paraffin (kerosene) emulsion, at a strength of 10 per cent. paraffin. Dissolve 1 lb. soap in 2 gallons of boiling water. Remove from fire and add 4 gallons of paraffin. Churn violently through the spray pump for 5 minutes or more. The result is a thick, creamy liquid which may be kept as a stock solution. It can be diluted with 6½ times its bulk of water for use.

There are other aqueous emulsions, largely of coal tar derivatives, which are stated to kill fowl ticks on contact, but they need to be made very strong and are consequently rather expensive if used liberally, as liquids commonly need to be for the purpose in view. Amongst these liquids are included the following, the percentage stated referring to the dilution in water:—(1) Jeyes' fluid, 10 per cent.; (2) Lysol, 10 per cent.; (3) carbolic acid, 5 per cent.; (4) Cyllin, 5 per cent.; (5) Cresol soap, 5 per cent.

Other substances used are of the nature of mineral oils, without water, namely:—(1) Crude oil; (2) paraffin; (3) carbolineum diluted with half its volume of paraffin.

These liquids are, of course, still more expensive, but are particularly useful for individual treatment of cracks in timber and other restricted hiding places.

There are also certain proprietary preparations which are stated by the manufacturers to kill fowl ticks. They commonly have a kerosene base with other ingredients, including some which have a fumigatory value, *e.g.*, paradichlorbenzene. They are intended to be applied through an atomiser, of which the simplest form is the common household fly sprayer.

In general, paraffin emulsion appears to be the most suitable application. The interior of infested fowl houses can be sprayed at regular intervals to keep down the pest, using a bucket pump for the purpose. Every effort must be made to drive the liquid into all cracks and similar hiding places.

Blow lamps can be used to good effect in brick or iron buildings. In the case of houses constructed entirely of iron the temperature of the metal can often be raised sufficiently to kill lurking ticks by making a fire inside the structure, although this may injure the galvanised iron if too much heat is produced, and in any case is somewhat objectionable on account of tending to blacken the interior of the structure.

Control of these pests is rendered much easier if the houses afford a minimum of hiding places. Brick walls should be smoothly plastered, preferably with cement plaster, and the floors should be cemented. Cracks in woodwork can be filled up with coal tar.

All perches and nesting boxes should be removable so that they can be treated thoroughly if necessary.

It has been recommended that the perches be slung on wires which pass through soldered on tin cups to be filled with old motor oil. The idea is, of course, to prevent the ticks from getting to the fowls at night. It is probably better, however, to have the perches more stable and to guard against the ticks crawling up the supports by interposing cups filled with oil, as above. The Poultry Officer recommends that the cross pieces for the perches be supported on bolts set in cement in the centre of old pipes, the tops of which are filled with oil and have a guard to prevent dirt and feathers from forming a bridge for the ticks. The cups must be kept constantly filled with oil and free from dirt. Where dropping boards are in use the perches may be supported on legs which rest in oil cups on the boards. If this is done it is necessary to see that there is ample perch accommodation for the birds and that the latter use them for roosting. It is hardly necessary to point out that control of the roosting of the birds is essential to control of fowl ticks. Trees are very

liable to become heavily infested if the birds are allowed to roost in them, and fowls running loose and roosting promiscuously may infest outbuildings, implement sheds, etc., where effective measures against ticks are extremely difficult if not impossible.

TABLE OF DISEASES KNOWN TO BE TRANSMITTED BY SOUTHERN AFRICAN TICKS.

Disease	Host.	Transmitted by	No. of Hosts	Stage in which infection acquired.	Stage in which infection transmitted.
East Coast Fever	Cattle	Brown Tick	3	(1) Larva (2) Nymph	(1) Nymph (3) Adult
		Red Tick	2	Nymph	Adult
		Black-pitted Tick	3	(1) Larva (2) Nymph	(1) Nymph (2) Adult
		Cape Brown Tick	3	(1) Larva (2) Nymph	(1) Nypmh (2) Adult
Redwater	Cattle	Blue Tick	1	Adult	Larva
		Brown Tick	3	(1) Adult (2) Nymph	(1) Larva (2) Adult
		Red Tick	2	(1) Adult (2) Nymph	(1) Larva (2) Adult
Gallsickness (Anaplasmosis)	Cattle	Blue Tick	1	Adult	Larva
		Black-pitted Tick	3	Adult	Larva
Gallsickness (Theileria mutans)	Cattle	Brown Tick	3	?	?
		Red Tick	2	Nymph	Adult
Biliary Fever	Equines	Red Tick	2	Nymph	Adult
Biliary Fever	Dog	Dog Tick	3	(1) Adult	(1) Adult
		European Brown Tick	3	(1) Larva (2) Nymph	(1) Nymph (2) Adult
Heartwater	Cattle	Bont Tick	3	(1) Larva (2) Nymph	(1) Nymph (2) Adult
	Sheep Goats	Variegated Tick	3	(1) Larva (2) Nymph	(1) Nymph (2) Adult
Spirochaetosis	Horse Cattle	Blue Tick	1	Adult	Larva
	Sheep	Red Tick	2	Nymph	Adult
Paralysis	Sheep Goats	Russet Tick	3	?	Adult
Sinkobe Disease	Cattle	Variegated Tick	3	?	Adult (probably)
Spirochaetosis	Fowl	Fowl Tick	Many	Remain infective indefinitely after feeding on infected birds and may transmit infection for at least two generations.	
African Relapsing Fever	Man	Tampan	Many	Adult	Nymphs & adults. Hereditary to three generations.

SPECIES OF TICKS RECORDED TO DATE IN SOUTHERN RHODESIA.

Species of Tick.	Hosts of Adults recorded in S. Rhodesia.
Ixodes pilosus, Koch . . .	Dog.
Haemaphysalis aciculifer (Warbn) Bushbuck, Melsetter district	
Haemaphysalis leachii (Aud) .	Dog. Wild Cat.
Dermacentor rhinocerotis (De Geer)	Rhinoceros, Hippopotamus
Rhipicentor nuttalli, C. & R. ...	Porcupine, Dog
Rhipicentor bicornis, N. & W.	Dog.
Rhipicephalus appendiculatus, Neum	Cattle, Horse, Zebra, Buffalo, Sable Antelope, Roan Antelope, Kudu, Livingstone's Suni, Steenbuck, Klipspringer, Hare
Rhipicephalus capensis, Koch	Buffalo, Bushpig.
Rhipicephalus evertsi, Neum.	Cattle, Buffalo, Roan Antelope, Sable Antelope, Tsessebe.
Rhipicephalus sanguineus, Latr	Cattle, Dog
Rhipicephalus sulcatus, Neum	Dog.
Rhipicephalus simus, Koch	Cattle, Horse, Dog, Cat, Man, Buffalo, Kudu, Sable Antelope, Warthog, Bushpig, Leopard.
Rhipicephalus supertritus, Neum.	Kudu (and off grass)
Margaropus winthemi, Karsch	Cattle and horses imported from Union of S. Africa.
Boophilus decoloratus Koch	Cattle, Horse, Buffalo, Roan Antelope, Sable Antelope, Impala
Hyalomma aegyptium aegyptium. (L)	Cattle, Horse, Buffalo, Eland, Kudu, Roan Antelope, Sable Antelope, Warthog
Hyalomma aegyptium impressum Koch .	Cattle, Buffalo, Eland, Roan Antelope (Nymphs on Swallow).
Amblyomma hebraeum, Koch	Cattle, Sheep, Horse, Buffalo
Amblyomma marmoreum, Koch	Buffalo, Rhinoceros, Tortoise
Amblyomma nuttalli, Donitz	Tortoise
Amblyomma petersi, Karsch	Rhinoceros
Amblyomma gemma, Donitz	Cattle
Amblyomma variegatum (Fab)	Cattle.
Amblyomma pomposum, Donitz	Cattle, Buffalo
Amblyomma eburneum, Donitz	Cattle, Buffalo, Eland.
Aponomma laeve, Neum.	Cobra.
Aponomma exornatum (Koch)	Varanus (Monitor Lizard).

REFERENCES AND ACKNOWLEDGEMENTS.

The following authors were consulted in connection with the preparation of this article:—

Bedford, G. A H —Ticks found on Man and his Domestic Animals and Poultry in South Africa Journ. Dept. Agric., S.A. Union, July, 1920.
The Spinose Ear Tick. Pamphlet Local Series No. 18, Union of South Africa, Dept. Agric.

Bedford, G. A. H. and Graf, H.—Ticks. Tick-borne Diseases and their Eradication in South Africa. Fmg. in S. Africa, XIV. March, 1929.

Cooper & Nephews, Wm.—Ticks in relation to Diseases of Stock. Pamphlet.
The Ear Tick and how to treat it. Cooper pamphlet No. 1, Johannesburg.

Howard, C. W.—A List of the Ticks of South Africa. Annals. Transvaal Museum, Aug., 1908.

Laurie, D. F.—The Poultry Tick, Bull. No. 74, Dept. Agric., South Australia.

Lounsbury, C. P.—Annual Reports, Dept. Agric., Cape of Good Hope, 1900, 1901, 1902, 1903; and several articles in Cape Agric. Journal.

Neumann, Prof. L. G.—Ixodidæ, Das Tierreich, Berlin, June, 1911, and supplementary publications.

Nuttall, Warburton, Cooper & Robinson.—Ticks: a Monograph of the Ixodoidea. Parts 1, 2 and 3. Cambridge University Press.

Robinson, L. E.—Re Amblyomma variegatum nocens. Parasitology, Vol. IV., No. 4, Jan. 8, 1912.

Story, Colin.—The Spinose Ear Tick. Practical Suggestions for Suppression. Journ. Dept. Agric., S.A. Union, Oct., 1920.

Theiler, Sir Arnold.—Diseases, Ticks and their Eradication. Journ. Dept. Agric., S.A. Union, Feb., 1921.

Watkins-Pitchford, Lieut.-Col. H.—Dipping and Tick-destroying Agents. P. VIII. Reprinted from Agric. Journ., S.A. Union, in Rhod. Agric Journ., Dec., 1911.

The illustrations in the Plates are original with the exception of figs. 15 and 16 on Plate I., which were roughly copied at a reduced size from Messrs. Wm. Cooper & Nephews' pamphlet "Ticks in relation to Diseases of Stock," and the figures of the Spinose Ear Tick on Plate II. The latter were copied or compiled from figures appearing in Messrs. Nuttall & Warburton's "Ticks: A Monograph of the Ixodoidea."

As modern as to-morrow is the slogan of to-day that *"Cleanliness Aids Insect Control."*

Farming Calendar

FORESTRY.

MAY.

Start pricking out seedlings into tins. Deciduous trees which are propagated by means of cuttings should be taken in hand. See that the fire lines are in order, and in the case of woods which have formed canopy, remove inflammable material below the edge trees.

JUNE.

Care should be taken by further ploughing of land or burning of grass that all fireguards round plantations are in good order and effective. Thinnings may be carried out where necessary. Cuttings may be taken and struck now of deciduous trees, such as the Carolina poplar. The pricking out of conifer seedlings into tins should be continued, and sowing of such seed for the coming planting season may be completed. A commencement may be made of preparation of land to be planted during the ensuing season, e.g., by stumping if necessary, and ploughing where practicable.

CROPS.

MAY.

Witchweed may still require attention on the stooked lands. Continue to cut and stook maize as it matures: make the stooks small to assist drying and prevent increase of diplodia Later in the season the stooks may be made larger See that the stooks are secure and pick up plants lying on the ground. Continue to plough up land between stooks of maize Give all maize harvested, whether husked or in the husk, a chance to dry out before riding to the dumps. Do not begin shelling if the ears are still damp. Do not use new grain bags for harvesting maize. Make the dumps of unhusked ears as small as possible; the smaller the dump the quicker the grain will dry out. Grain on the cobs dries extremely slowly, if at all, in dumps of large size. Do not mix unhusked ears from the stooks with dryer ears harvested later from the standing crop. Keep the drier ears in a separate dump; shell, bag and stack such maize separately. When cutting maize for stooking, insist on the stalks being cut at ground level. The plough, in Rhodesia, will not bury roots with stalks 8 to 12 inches high. A long stubble of stalks makes clearing of the ground for ploughing very tedious and expensive. If not already harvested, ground nuts should be lifted before the first frosts damage the hay. Sow most winter cereals on wet vleis or under irrigation early this month. Feed your sweet potato vines to stock; if frosts occur the vines will be killed. Dig and feed tubers from end of month onwards. Towards end of month harvest cattle pumpkins and melons and handle carefully; avoid bruising to prevent rotting. Place pumpkins and melons in a dry situation in the open and in a single layer. Supply plenty of roughage to cattle pens, kraals and stables to increase the manure supply. Collect and cart manure to lands for spreading. Do not attempt to plough in dry grass or quantities of maize refuse. The plough will not turn it under and it will not rot before next planting season. Burn such refuse and make a good job of the ploughing. If the weather seems set fair, commence brickmaking. A small kiln of bricks always on hand is most useful. As labour permits, re-thatch buildings and outhouses in need of repair. Overhaul, grease and paint planters, drills and other implements not required again until next season, and store away under cover. Think about your fertiliser requirements for next season and place your orders. From now onwards the second ploughing of new land broken up earlier in the season should be pushed on with as opportunity offers.

JUNE.

Select seed from the very best of your own crops. It is always wise to keep more seed than you may need for planting. Do not shell and ride your maize to the railway unless it is fit for export or market. Provide

ample dunnage for your maize stacked at the railway or on the farm. Use maize cobs; husks are almost useless for this purpose. Select pumpkin and melon seed from the best specimens. Support your agricultural show and make it a success by preparing and entering as many exhibits as you can. No one is more to blame for a poor show than the farmers themselves. Make a list of the seed requirements for next season, and where purchases must be made, place the orders early. Veld fires must be anticipated, and if not already attended to, the mowing or burning of fireguards, both boundary and internal, should be proceeded with.

STOCK.

MAY.

Cattle.—By the middle of this month dairy cattle will require more serious attention in the matter of feed. Grass should be cut for bedding, and both cows and calves, if the weather is too cold, should be well bedded down at night from now onwards, and cowsheds should be put in good repair. Attention should be given to the water supplies, and care taken that they are clean and sufficient.

Boggy sources of water supply are a frequent source of loss of cattle during the winter months. With adequate water supplies cattle can withstand considerable shortage of grazing. Weaners should be fed a good roughage ration with or without a small allowance of grain, depending on circumstances—to keep them growing through the winter months.

Get in the bullocks for winter fattening.

Sheep.—Especially from now on the ewes and lambs should have adequate feed such as green oats and barley or bean hay and a little maize. This will ensure an adequate supply of milk and hence good thrifty lambs. Dose for nodular worm.

JUNE.

Cattle.—Cows with autumn calves should be kept in the more sheltered paddocks. A watchful eye should be kept on all watering places in order to prevent their being fouled or stopped up. Where winter calves are required, the bulls should be kept out of the herd until the end of July at least, and, in the meantime, they should be well fed and cared for in order to fit them for their work. The three watchwords in the dairy herd should be fed, shelter and bedding from now onwards.

At this period of the year winter feeding of dairy stock should commence in real earnest. The milking cows should now be in fairly good condition, and in order to maintain a full flow of milk throughout the cold, dry months of winter, it is essential that liberal feeding be practised. As far as possible an attempt should be made to imitate summer conditions by feeding an abundance of succulent and palatable food. Maize silage, sweet potatoes, pumpkins, etc., are very useful for this purpose, but these feeds should be supplemented by dry roughage of good quality, preferably a legume hay, and a liberal allowance of mixed concentrates.

For dairy heifers, weaned calves, etc., there is possibly no better ration than one consisting of maize silage, legume hay and a small portion of mixed concentrates, and these feeds, if supplied in liberal quantities, should serve to keep the young stock in a thrifty, growing condition.

Sheep.—Continue to feed the ewes and lambs well. It is of considerable assistance against parasites. Dose again at three weekly intervals for wireworm and bankrot worm.

DAIRYING.

MAY-JUNE.

At this time of the year the farmer should experience very little difficulty in producing cream of first-grade quality. During the winter months the separator should be adjusted so as to deliver cream testing 40 per cent. butter fat.

On exceptionally cold days care should be taken that the milk is not allowed to become too cold before separation—for efficient skimming, the milk should be separated immediately after milking at a temperature not lower than 90 degrees F.

Farmers engaged in butter-making are usually successful in obtaining a good grain and firm body in butter at this season of the year. During cold weather it is frequently necessary to warm the cream for churning. The most satisfactory method of warming the cream to the proper churning temperature is to place the bucket or receptacle containing the cream in a tub or bath of water at a temperature of about 95 degrees F., stir the cream frequently and replace the water when cold.

Under the cool conditions which obtain from this time of the year onwards, cheese-making operations are usually most successful.

Care should always be exercised, however, in using evening's milk. If the milk is over-acid it should not be used, or a hard, dry cheese will result. Morning's milk plus a starter usually gives the best quality of cheese The starter should have a clean sour taste and smell. In early winter, milk for cheese-making frequently contains a high percentage of fat, and in order to firm the curd properly in the whey it is usually necessary to raise the scalding temperature a few degrees.

VETERINARY.

JUNE-SEPTEMBER

After the first frost danger of horse sickness should disappear and blue tongue in sheep should be very little in evidence, sheep should be inoculated against this disease. Although cases of redwater and gallsickness occur all the year round, these diseases should not be prevalent. Scab in sheep and goats is a winter poverty disease and may be in evidence. Vegetable poisoning may be in evidence towards the end of August, especially on burnt veldt and with the first appearance of young green shoots.

WORM-HOUR STATISTICS.

The caterpillar or worm known to all maize growers as stalk-borer is stated to live for about 30 days, feeding during this time for about 25 days. The so-called idle periods are occupied in the development of a larger appetite. The worm thus has about 600 hours in which to feed. In an almost unnoticeable infestation then, say 100 worms per acre on a 100-acre land, there are 6,000,000 worm-hours of feeding per generation of caterpillars. With an average of 2½ generations per season the figure is brought to 15,000,000 worm-hours of feeding, feeding, feeding, while the pests worm their way to maturity. (How many worm-years—**quick?**)

If all these worm-hours were placed end to end they would be enough to discourage over 1,500 four-hundred day clocks, and make them run down. Worm-hours can certainly make farms look run-down and reduce yields. But the farmer need not be discouraged for the following reason:—Clocks need cleaning, or they cease to function, and the same applies to farm lands.

By keeping his farm lands and vicinity clean **throughout the year,** the farmer can abolish many millions of worm-hours during which various pests may damage his crops. Cleanliness has the effect of setting the clock back towards the days of new farming areas and good yields, when crop waste and weeds had not yet been present for long enough to generate the deadly poison of worm-hours.

Cleanliness brings more and better food for Victory.

Cleanliness Aids Insect Control.

S.R. Milk Recording Scheme.

HERD AVERAGES: 1940/41.

Owner.	Average lbs Milk	Average lbs. B. fat.	Average No. of days.	Breed.
J. A. Baxter . .	7,474.96	281.65	283	Grade Friesland.
J. R. Bedford	5,317.43	213.37	287	Grade Friesland.
A. L. Bickle . .	7,218.95	256.54	275	Grade Friesland
Bluff Hill Dairy .	6,620.66	245.64	292	Grade Friesland.
Boyd Clark Est	5,547.68	183.03	272	Grade Friesland.
E. W Brighten	4,926.31	195.60	289	Grade Friesland.
K M Campbell	6,093 20	239.86	289	Grade Red Poll.
Coldstream Dairy	5,441.13	200.61	278	Grade Friesland.
T. Cousins .	5,794.01	208.89	276	Grade Friesland.
H. A. Day.	5,377.13	196.73	282	Grade Friesland.
W. V Fitzgerald	4,133.50	148.00	287	Grade Friesland
P Freeland .	4,586 60	157.77	277	Grade Friesland
H. V. Gibbs	5,836.90	198.05	291	Grade Friesland.
Gower Hill Dairy	4,944.92	183.80	280	Grade Friesland.
F. Grossman	4,044.20	153.84	280	Grade Friesland
W. D. Haywood	4,337.37	175.06	287	Grade Friesland.
E. C. Holmes .	4,245.39	160 85	298	Grade Friesland
D. J. Huddy	6,018.87	198.58	272	Grade Friesland.
G. M. Huggins .	4,485.28	175.23	268	Grade Friesland
Mrs. M. Huxham	4 645.45	168.09	285	Grade Friesland.
Mrs. E N. Lamb	4 819.00	186.50	262	Grade Friesland.
V. A Lawrence	6,024.27	204 27	297	Grade Friesland.
A. H. MacIlwaine	4,588.42	187.97	268	Grade Red Poll
F. H. R. Maunsell	5,153.13	216.93	271	Grade Friesland.
Mazoe Citrus Est.	5,882.87	200.46	276	Grade Friesland
Meikle Bros. .	7,404.21	257.75	288	Grade Friesland
W. S. Mitchell	7,587.82	263.48	291	Grade Friesland.
S Moore	4,864.06	200.49	269	Grade Friesland.
R. L. Morant . .	4,113.44	168.27	299	Grade Ayshire.
G R. Morris .	4,002.06	175 10	274	Lincoln Red Shorthorn
F. B. Morrisby	7,562.34	255.57	295	Grade Friesland.
W. M. Nash	4 280.88	172.80	281	Grade Friesland.
F. Neill .	7,173.10	253 77	284	Grade Friesland.
H. A. Coke Norris	3,995.07	162 51	295	Grade Friesland.
Red Valley Estate "P" .	5,808.51	213.48	275	Grade Friesland.
Red Valley Estate	6,357.92	243.20	283	Grade Friesland.
Rhodes Matopo Est	4,940.40	193.00	282	Grade Red Poll and Grade Friesland
W. F. H Scutt	6,028.55	223.35	281	Grade Friesland.
R. R. Sharp	5 240.87	180.77	293	Grade Friesland.
W. Sole	7,487 56	265.61	295	Grade Friesland.
A. Stokes	7,375.81	279.86	289	Grade Guernsey and Grade Friesland.
W. E. Tapson	4,877 66	191.62	251	Grade Ayshire and Grade Friesland.
J. G. Thurlow .	4,620.21	184.09	284	Grade Red Poll
P. S. Timms .	3,352.91	107.19	256	Grade Friesland.
W. E. Tongue	8,252 87	301.71	291	Grade Friesland
A. M. Tredgold	3,935 67	158.66	274	Grade Red Poll.
Quinnington . .	5,169 85	179.80	272	Grade Friesland.
A. F. H. Valentine	3,639.67	148 19	286	Grade Guernsey and Grade Friesland.

Southern Rhodesia Veterinary Report.

FEBRUARY, 1942.

Diseases.—Anthrax was diagnosed in the Belingwe Reserve, Belingwe native district and in the Chikwanda Reserve, Gutu native district.

Tuberculin Test. Ten bulls, eight heifers and nine calves were tested on importation. There were no reactors.

Mallein Test.—Thirteen horses and thirty two mules were tested on importation with negative results.

IMPORTATIONS.

Union of South Africa.—Bulls, 10; heifers and calves, 17; horses, 13; mules, 32; sheep, 502

Bechuanaland Protectorate.—Sheep and goats, 375.

EXPORTATIONS.

Portuguese East Africa.—Slaughter cattle, 120; sheep and goats, 184; pig, 1.

Northern Rhodesia.—Bulls, 4, mules, 4; sheep, 84.
Bechuanaland Protectorate.—Goats, 2.

EXPORTATIONS—MISCELLANEOUS.

In Cold Storage.

United Kingdom.—Beef quarters, 1,854; buttocks, 439; tongues, 2,327 lbs.; livers, 5,030 lbs; tails, 1,043 lbs.; fillets, 1,070 lbs.

Northern Rhodesia.—Beef carcases, 621; mutton carcases, 84; pork carcases, 39; offal, 12,828 lbs.

Belgian Congo.—Beef carcases, 239; mutton carcases, 24; pork carcases, 6; veal carcases, 7; offal, 2,641 lbs.

Meat Products from Liebig's Factory, West Nicholson.

Union of South Africa.—Meat paste, 8,497 lbs; assorted sausages, 15,464 lbs.; assorted lunch rolls, 14,330 lbs.

B. L. KING,
Acting Chief Veterinary Surgeon.

MARCH, 1942.

Diseases.—No fresh outbreaks.

Tuberculin Test.—Two bulls on exportation were treated with negative results.

Mallein Test.—Seventeen horses and thirty mules were tested with negative results.

IMPORTATIONS.

Union of South Africa.—Horses, 17; mules, 54; sheep, 467.

Bechuanaland Protectorate.—Sheep and goats, 289.

EXPORTATIONS.

Northern Rhodesia.—Bull, 1; cows and calves, 15; sheep, 126; donkeys, 12.

Belgian Congo.—Mules, 22; sheep, 104.

Portuguese East Africa.—Slaughter cattle, 120; bulls, 2.

EXPORTATIONS—MISCELLANEOUS.

In Cold Storage.

United Kingdom.—Beef quarters, 7,101; boneless beef quarters, 1,818; veal carcases, 196; tongues, 14,238 lbs.; livers, 11,749 lb.; hearts, 8,673 lbs.; tails, 5,558 lbs.; fillets, 1,263 lbs.; tongue roots, 1,363 lbs.; skirts, 3,754 lbs.; shanks, 3,793 lbs.

Northern Rhodesia.—Beef carcases, 395; mutton carcases, 94; pork carcases, 55; veal carcases, 6; offal, 10,157 lbs.

Belgian Congo.—Beef carcases, 265; mutton carcases, 20; offal, 1,839 lbs.

Meat Products from Liebig's Rhodesia Ltd. Factory, West Nicholson.

Union of South Africa.—Corned beef, 115,806 lbs.; meat paste, 5,850 lbs.; assorted sausages, 4,704 lbs.; assorted lunch rolls, 15,364 lbs.

Egypt.—Assorted sausages, 3,150 lbs.; assorted lunch rolls, 1,367 lbs.

Northern Rhodesia.—Corned beef, 147,759 lbs.; assorted sausages, 1,032 lbs.; assorted lunch rolls, 5,160 lbs.

B. L. KING,
Acting Chief Veterinary Surgeon.

SOUTHERN RHODESIA
Locust Invasion, 1932-42.

MONTHLY REPORT No. 111. FEBRUARY, 1942.

The Red Locust (*Nomadacris septemfasciata*, Serv.)

Hoppers have appeared in the following additional districts, namely, Insiza, Gwanda and Darwin.

In the Victoria district, where hatchings were reported last month, a further locality below the Umshandigi Dam is reported to be infested.

Measures to destroy the hoppers are being given effect in all infested areas.

RUPERT W. JACK,
Chief Entomologist

MONTHLY REPORT No. 112. MARCH, 1942.

The Red Locust (*Nomadacris septemfasciata*, Serv.)

Hoppers appeared in the Ndanga and Chibi districts. Egg-laying was reported from these districts during January.

The destruction of hoppers in all infested areas is being carried out.

J. K. CHORLEY,
Acting Chief Entomologist.

THE RHODESIA
Agricultural Journal

Vol. XXXIX.] No. 4 [July-August, 1942

Editorial

Notes and Comments

Livestock Improvement Scheme: Apply Now!

The attention of stock farmers is directed to the urgency of submitting applications for assistance towards the purchase of stock in terms of the Livestock Improvement Scheme for the financial year ending 31st March, 1943 (a notice of which appears in this issue) **at the earliest possible date and not later than 31st July, 1942.** Full particulars of this Scheme may be obtained from the Secretary, Department of Agriculture and Lands, P.O. Box 387, Salisbury. Stock farmers should make the fullest possible use of the facilities provided, and by applying as soon as possible, will materially assist in avoiding expense in unnecessary travelling and inspections by the limited staff now available. It is pointed out that applicants under last year's Scheme (i.e., prior to 1st April, 1942), who did not take advantage of any grant approved, must re-submit their applications for consideration in terms of the current Scheme.

Certified Seed Maize and Wheat.

Do not forget that the most important link in the chain of production is the SEED you sow.

Do not deceive yourself after spending money on ploughing, cultivation, fertilisers, etc., by sowing cheap seeds under the impression that you are saving money. Not at all—cheap seeds often prove dear in the end, whilst the best seeds invariably prove to be the cheapest; in other words, many farmers actually pay too much in the end by paying too little in the beginning!

On the recommendation of the Production Committee, the Government has agreed to pay a subsidy of 10s. per bag on certified seed maize purchased from the Seed Maize Association at 40s. per bag. The cost of the certified seed, therefore, is only 30s. per bag to the purchaser. To obtain the subsidy of 10s. per bag purchases must be made through the agents, the Farmers' Co-op, Ltd., Salisbury.

In your own and the Colony's interest SOW CLEAN—TESTED—CERTIFIED SEED MAIZE and WHEAT.

Treatment of Tobacco Seed—Chemistry Branch.

The Chemistry Branch is prepared to carry out, as far as possible, the cleaning and treatment of tobacco seed during the coming season, but as the Branch is suffering from shortage of staff and pressure of other duties, tobacco farmers are earnestly requested to forward their seed as early as possible, as the treatment will be carried out in strict rotation; lack of staff may mean that seed sent in late in the season cannot be dealt with by the Branch.

No seed will be accepted for treatment after 30th September.

Grain Bins.

More and more farmers are now building bins in which to store their grain, beans and other products. Whilst little has been heard from those who are entirely satisfied with this sack-saving and rodent- and weevil-preventing method of storage, a few instances of damage to maize by moisture have been reported.

In most of these cases, it seems, there is but little suspicion that the grain was not well dried before being placed in the bin. Thus the cause probably lies in the construction of the bin, or the site chosen for it. It should be borne in mind that the base of the bins should have a proper damp course, and be raised above ground level. When possible, exposure of the wall and roof to the sun should be avoided. The roof should be so constructed that rain-water will drip from it without touching the walls. The bins should be on a well drained site, shaded where possible.

A suggestion for the protection of walls and roof from dampness from outside or inside is the use of good thatching on the roof, projecting well over the wall, and a mat of sunflower or other suitable stalks tied on to flexible purlins fixed to the outside of the wall. The purlins keep the stalks an inch or so from the wall and should therefore help in the drying out of the stalks after rain. The stalks should protect the wall from the heat of the sun, and to some extent, from rain.

A method of dealing with dampness at the bottom of the bin was dealt with in the correspondence columns of this Journal in October, 1940, by Mr. Finch, of Marandellas. His letter should be consulted. It should also be borne in mind that damp in the bottom of the bin may in some cases be caused by hot sunshine on wall or roof.

The Soil and the Farmer.

In connection with the "Dig for Victory" campaign in Britain and overseas, the following interesting communication has been received from Mr. Grafton Phillips, of the Rhodesia Tea and Coffee Estates, Ltd., Chipinga, by the Food Production Committee:—

"There have been many failures in Britain and much time, money and energy has been wasted due to crops being planted on unsuitable soil. Before proceeding with these schemes in this Colony, farmers would be well advised to read the article "Science and the Farmer," by Professor J. A. Scott Watson, of Oxford University, which appeared in this Journal in October, 1941 (pp. 560-579). On pages 565 and 566 will be found most useful details regarding crops and soil. In business, every care is taken to see that the right man is in the right place. In agriculture the same care should be taken to see that the right crop is planted in the right soil. If this aim were taken seriously, then a large number of failures would vanish, and success would be the order of the day. Every would-be producer should send a sample of his soil to Salisbury with a request that the Agricultural Department advise him regarding the most suitable crop to grow on that soil. One hears of "good farmers" and "bad farmers," but in many cases the soil is responsible for these reputations. A very small variation in the soil acidity makes all the difference between success and failure. Producers should be advised accordingly. Here, our farm lands never produce a good stand of maize, but beans generally do very well. It might be advisable for other farmers in this area to give up maize and go in for beans."

Our correspondent rightly emphasises *soil acidity* as one of the important factors influencing crop growth; some crops such as lucerne, barley, certain clovers and sugar beet thrive only on an alkaline or "sweet" soil. Readers who are curious about this subject should read the short explanation given in this Journal for June, 1940, pp. 376-378. In connection with the taking of soil samples for analysis by the Chemistry Branch, it should be pointed out that this sampling must be done properly—a few handfuls scraped up, at random, are worse than useless for this purpose. Farmers who intend submitting samples should obtain a copy of Bulletin No. 758 (free on application) in which instructions are given on the correct method of taking soil samples.

Winter Host Plant of the Tobacco Aphid.

Dr. C. K. Brain, of the Tobacco Research Station at Trelawney, has described in a pamphlet just issued by the Tobacco Research Board (which is now reprinted in this Journal), two important winter host plants of the Tobacco Aphid. These plants belong to the genus Gynandropsis (Capparidaceae) which includes the garden Cleome, *G. speciosa*, and *G. pentaphylla*, a small plant called by the natives RUNI, TSUNA or NYEVE. *G. pentaphylla* occurs throughout Africa north of the Transvaal, and it has been found in and around native compounds, being used by Africans as a spinach. It is obvious then that *all* farmers, and not only tobacco growers, should make an effort to destroy these plants in tobacco-growing areas and in this way assist in the reduction of initial infestation of the tobacco lands by the pest. Dr. Brain is to be warmly congratulated on his discovery.

OBITUARY

ALEXANDER CUTHBERTSON, Dip. Agric., F.R.E.S.,
Department of Agriculture.

We regret to announce the death of Mr. Alexander Cuthbertson, Entomologist in the Department and Acting Editor of this Journal. The late Mr. Cuthbertson was born in Glasgow, 12th March, 1901, and was educated at the West of Scotland Agricultural College, where he received a thorough training in general farming practice. He took up the study of insect pests as a hobby and then more seriously, being particularly attracted to the biology of insects and their life histories. He joined the Department in 1926 as Entomologist and immediately became interested in the Diptera or Two-Winged Flies, making a special study of the Muscidae, a group of flies of vital economic importance in Africa. He published many scientific papers on the biology of these flies, including the parasitic Tachinidae. Always a keen collector, the Department collection grew rapidly under his care and became enriched with many type specimens of insects new to science.

His duties brought him into close contact with the farming community, who regularly sought his advice on the many problems of insect pest control. Since the outbreak of war he has been an active member of the 1st Rhodesia Regiment.

The Department has lost a keen worker and his colleagues a sincere friend.

He leaves a wife and infant son, to whom we extend our sincere sympathy.

Tsetse Fly Operations, 1941

SHORT SURVEY OF THE OPERATIONS BY DISTRICTS FOR THE YEAR ENDING DECEMBER, 1941.

By J. K. CHORLEY, Entomologist.

[Extracted from the Annual Report of the Chief Entomologist.]

During the year 1940 the zones covered by our operations were pushed forward over most of the northern front with a twofold object in view, firstly to give additional protection to the ground—totalling over 6,000 square miles -already recovered from the tsetse, and secondly to create, as time went on, another cleared belt along the whole front. The year under review can be described as one of quiet, but effective consolidation of the newly occupied advanced positions. Road communications have been improved, hunting posts re-distributed as our local knowledge of the area increased as a result of continuous reconnaissance and density surveys. In one area alone a considerable increase was made in the number of native hunters employed. This was in the Urungwe sub-district, where an intensive effort is being made to render the whole of the Urungwe Native Reserve safe for cattle in the immediate future. A large scheme of native settlement is to be carried out during 1942 in the eastern portion of the Reserve rendered safe for cattle as a result of these operations. An officer of the Native Department has spent several months in the reserve surveying the land, demarcating pastoral and agricultural areas, siting dip tanks, soil and water conservation works, etc., and generally preparing the way for the incoming natives in a well-planned scheme of centralised native settlement. A site for a native clinic has been selected near our main camp. Owing to the low density of the present native population and the absence of cattle over most of the area, little soil erosion has occurred in the past, the land is virgin and fertile compared with most native areas, and with the development of water supplies, capable of holding a fairly dense native population. This is the first planned scheme of native settlement to be undertaken on land reclaimed from the tsetse in this Colony. A large scheme for post-war European settlement is also being planned in this area, and to protect it our hunting posts have been pushed forward to the escarpment.

Native cattle have continued to increase in all areas previously cleared of tsetse, particularly in the Darwin district (Kandaya Reserve), the Doma area and in the Bubi District west of the Shangani Reserve. In this last area, so urgent is the demand for new grazing that the native cattle are pushed forward behind the retreating fly with an embarrassing precipitancy. Almost as soon as an area has been cleared and before we are sure that

it is safe to introduce cattle, requests are received from the native people to be allowed to introduce cattle or to be permitted to move into the area.

On the Eastern Border (Melsetter District) there was an increase in the number of cases of animal trypanosomiasis compared with the previous year, and the incidence of the disease was far more widespread. Further extensive clearing operations were carried out in the Inyamadzi Valley—the main channel along which the two species of tsetse involved enter the Colony—and the old clearings were maintained by periodical slashing back of re-growth and late burning.

The steady spread of *Glossina morsitans* from Portuguese East Africa towards our border in the lower Melsetter District was again confirmed, one specimen being caught within a mile of the border. Inside the Colony some eleven cases of trypanosomiasis were diagnosed from the area served by the Honde Dip, thirty-two deaths occurring.

The game fences created in 1926 in the Gatooma area were taken down and utilised by the Public Works Department; the southern fence, in the Doma area erected in 1925, was sold and the fences in the Lomagundi S.W. area erected in 1930 were being dismantled at the end of the year.

One native hunter was killed and one seriously injured by rhinoceros.

The number of animals destroyed during the year was 20,512 for an expenditure of 43,286 rounds of ammunition, or 2.1 rounds per head.

A more detailed account of the operation in each district follows.

Darwin.—The operations in this district, which have been moved westwards as the fly has been driven back, now cover an area approximately twenty miles wide lying north of the escarpment from the Hoya River in the Darwin District to the Kadzi River in the Sipolilo sub-district. Game of most species is abundant throughout the greater part of the area and the operations, which have only been in progress in the new area about eighteen months, have up to date had little effect either on the game population or the density of tsetse. An odd fly has been caught south of the escarpment, invariably near a traffic route leading from the Zambesi Valley over the escarpment and most probably brought up on travelling natives. The number of native cattle in the Kandaya Native Reserve continues to increase. In 1930 there were approximately 300 head, to-day there are over 2,900.

Doma Area.—This is an extension of the Darwin area and runs north of the escarpment from the Kadzi River to the Angwa River. The position as regards game and tsetse is the same as described above for Darwin District. No tsetse were seen south of the escarpment during the year. The old base camp at Doma was utilised by the Lands Department as temporary headquarters for their Lands Inspector, who spent several months in the area cutting it up into farms for post-war European settlement.

Urungwe.—In view of the post-war plans for European settlement and the consequent large-scale movement of natives now living on Crown land into the Reserves, special efforts are being made to render all these areas safe for cattle. Extra hunters were placed west of the Urungwe Native Reserve and also north of Vuti tsetse fly chamber up to the escarpment. No tsetse were seen inside the Native Reserve, and the density of fly west of the Reserve has greatly diminished. Native cattle are being introduced into a number of areas previously infested.

Fourteen deaths from suspected animal trypanosomiasis occurred inside the Reserve, 10 being definitely diagnosed as such. A few suspected cases also occurred amongst cattle belonging to the Roads Department, which has been working close to Vuti chamber. With the help of the Assistant Native Commissioner, Miami, two new roads were cut, one to the junction of the Sanyati and Tengwe Rivers, the other running west through the Reserve towards the Sanyati River. These roads will be completed during the coming year.

An increase in the density of the fly below the escarpment along the main road to Chirundu was noticed. Game also appears to be on the increase in this area compared with two or three years ago. This area lies outside the zone of our present operations.

Lomagundi S.W.—The position in this area remains more or less the same as last year, that is to say, that the northern bank of the Umfuli River and the eastern bank of the Sanyati River up to the Tengwe River, have remained free from tsetse. West of the Sanyati River there has been little change in either the density of distribution of fly. The Copper Queen area has remained free from infestation.

Gatooma.—There is little change to report from this area. The west bank of the Umniati River is almost clear of tsetse down to the Sakugwe River, only an odd fly being seen during the year in the vicinity of Gowe. North of the Sakugwe River fly still persist in small numbers, particularly on the Nyhondi River and at a few vleis draining into the Umfuli River as at Ruswinga and Waka. Two small herds of elephant remain more or less permanently in the vicinity of the Nyhondi River roaming at times several miles north of the Umfuli River, and also west of the Sanyati River.

Chief Neusu with some of his people have moved into the cleared area on the Sakugwe near the old western fence. More of his people will move in as soon as the restrictions on the movement of cattle due to East Coast Fever in the Mondoro Reserve are abolished. This is the beginning of what may become a general movement to repopulate the Sanyati Native Reserve, depopulated since 1913, when it was decided to remove the native people on account of sleeping sickness. In practice the Reserve was never completely uninhabited.

Sebungwe.—With the exception of two small localities on the Mzola River, namely, Cewali Pan and Kakula, the whole area south of the M'Kulugusi Forest has remained clear of tsetse. At these two points only an occasional fly is encountered. On the Gwaai River there has been an influx of native cattle, a dip has

been built at the Halfway Hotel, and a cattle buying business inaugurated. This is an area which until recent years was infested with fly. On the Shangani River more cattle have moved in and a large movement of cattle belonging to Chief Mbegwa is likely to occur during the coming year. The whole of the native area lying west of the Shangani Reserve is now ready for development and more intensive settlement. North of the M'Kulugusi Forest a notable decrease in the fly density has occurred in the area covered by our operations.

Melsetter (Eastern Border).—There was a considerable increase in the number of cases of trypanosomiasis reported, and the disease was more widespread, resembling in distribution the outbreak of 1939. One hundred and five (105) cases were definitely diagnosed by smears from twenty-four (24) farms with 105 deaths. The total number of suspected cases was 252 on 33 farms compared with 132 suspected cases with 24 deaths during 1940. Owing to the drought, severe frosts and consequent poor grazing, a number of these cases where probably relapses, and poverty was probably an accessory factor.

Further extensive clearing was carried out in the Inyamadzi Valley and regrowth was suppressed over most of the old clearing by slashing and organised late burning. A small portion of the clearing of "Farfell" burnt badly owing to erratic winds. The southern end of the clearing on "Jersey" was not slashed back owing to pressure of other work. This section will be cleared up early in January, 1942.

The total number of tsetse caught in or near the clearing was 35, comprising 14 *G. brevipalpis* (10 male, 4 female) and 21 *G. pallidipes* (11 male, 10 female). Of this total 22 flies were caught in Rhodesia, consisting of 10 *G. brevipalpis* (7 male, 3 female) and 12 *G. pallidipes* (4 male, 8 female). With the exception of one *G. brevipalpis* caught in the valley of the Rusitu River, the remainder were caught on "Pendragon," "Grampians" and "Farfell," all border farms within the basins of the Inyamadzi and Cheredza Rivers.

Only twelve tsetse were caught by trapping compared with 22 in the previous year. These comprised 9 *G. pallidipes* (4 male, 5 female) and 3 *G. brevipalpis* (1 male, 2 female). Extensive repairs were made to the traps as the cloth fabric quickly perishes when continuously exposed to wind, sun and rain. At the end of the year only 148 traps were in serviceable condition.

A short reconnaissance survey of the Haroni and Rusitu Rivers south-east of Melsetter Village was carried out.

Sabi Valley.—Operations against game were commenced in this area late in 1940 owing to the continued spread of *G. morsitans* through Portuguese Territory towards our border. This spreading movement continued throughout the year, and one *G. morsitans* has been taken within one mile of the border. Thirty-two (32) deaths from suspected trypanosomiasis occurred at the Honde Dip, of these eleven were positively diagnosed from smears.

There were very few native cattle left in Portuguese East Africa north of the Sabi River in this area in October, and probably the remainder will die during the coming year. South

of the Sabi River, in the vicinity of Massengena, the disease appears to have spread far south of the river towards the Transvaal border. By courtesy of the Portuguese authorities a rapid survey of the position in Portuguese East Africa was carried out by a party consisting of both Union and Rhodesian officials.

Traffic Control: Miami-Zambesi Road.—An increase in the number of motor cars using this road is recorded, also an increase in tsetse taken at Vuti Cleaning Chamber. The number of flies taken at Chirundu has decreased. The increase at Vuti was expected owing to the increased density of fly below the escarpment. The figures given do not include certain military convoys.

The following traffic was examined:—

(a) Vuti Chamber.—1,098 motor cars bringing 61 fly (30 male, 31 female); 2,944 pedestrians, 488 cyclists (1,027 parties), bringing 6 fly (4 male, 2 female); total 67 fly (34 male, 33 female).

Compared with: 1932 (106); 1933 (94); 1934 (178); 1935 (454); 1936 (519); 1937 (241); 1938 (162); 1939 (62); 1940 (25).

(b) Chirundu Bridge.—745 motor cars bringing 49 fly; 1,972 pedestrians, 419 cyclists (878 parties) bringing 70 fly: total 119 fly (sex unknown).

Compared with 1940: 360.

Sweating Sickness

By D. A. Lawrence, B.V.Sc., Director of Veterinary Research.

"Sweating Sickness" is the name given to a peculiar disease of calves which is characterised, as the name implies, by profuse perspiration over parts of the outer skin.

CAUSE.

Although sweating sickness has long been recognised as a specific disease of calves and has been studied over a period exceeding twenty years its exact nature has not yet been determined. During the course of these studies much useful information has been accumulated, particularly in connection with the occurrence, symptoms and course of the disease, but even to-day its cause and method of transmission are unknown. It is not yet possible to state whether sweating sickness is an infectious disease, i.e., one caused by a specific infective germ or virus, or whether some non-infective factor is responsible for its development.

Evidence in support of the theory that it is an infectious disease is undoubtedly strong and has been generally accepted without serious question in the past. For example, historical records suggest that the disease was encountered in the Northern territories first and only subsequently came down through this country and eventually made its way to the Union of South Africa, the first serious outbreak being recorded there, in Swaziland, in about 1917. Du Toit in 1923 published his observations on the spread of sweating sickness over Natalia Ranch in Swaziland in which he traced the progress of "infection" from section to section and even from herd to herd. The general behaviour of outbreaks is very similar to what obtains in cases of infectious diseases. For example, it is usual to have first one or two isolated cases occurring and for these to be followed soon afterwards by several more, and then finally for the numbers to decrease until no fresh cases occur, i.e., a wave seems to sweep through during the actual sweating sickness season.

On the other hand, certain facts associated with the occurrence of sweating sickness do not support the theory of its being an infectious disease. All attempts to demonstrate the presence of an infective agent have failed, as have also all attempts at transmitting infection from one animal to another. Bacteriological cultures from the various organs have yielded only negative results. Blood and various body discharges have failed to set up infection when introduced to another animal by injection, scarification, rubbing in, etc. Putting sick and healthy calves together has failed to bring about infection through contact. In spite of these consistently negative results the theory of the disease being infectious has persisted, the belief being that an intermediate host and vector must be necessary for the propagation and transmission of the virus. Ticks, in particular, and

An unusual case of Sweating Sickness in an adult cow

to a lesser extent blood-sucking flies, have been suspected in this connection. At this laboratory, however, two cases of sweating sickness developed in stables under conditions where the possibility of ticks or blood-sucking flies occurring was so remote as to be completely disregarded. The stables were mosquito-proofed and the animals were maintained tick-free on bedding of wood shavings.

There is thus evidence both for and against the disease being of an infectious nature, but the question still remains what is the cause if it is not infectious? The answer to this is not forthcoming yet, but there are certain facts that point to its being an error of metabolism (which might be loosely put as a dietetic or digestive derangement), or possibly a vitamin deficiency. For example, the condition appears only during a definite season, i.e., normally the hottest and wettest time of the year, viz., January-March. This may be associated with the presence in excess, or, alternatively, the absence of some factor in the grazing which in turn is reflected in the milk. The response following the administration of liver preparations has been noted in Kenya and also in this country, lending support to the idea of the disease being dietetic.

There appear to be good grounds for believing that some factor or factors predispose to the development of the disease—it would be difficult otherwise to explain why, firstly, only a limited number of calves in a herd become affected, and,, secondly, why in one outbreak the percentage morbidity is high while, for example on the adjoining farm, none or only very few cases occur Two cases have come to my notice in which it was stated that the calves of particular cows always developed sweating sickness, the suggestion being that a predisposing factor might be inherited.

OCCURRENCE.

Sweating sickness is truly a seasonal disease. It need never be expected at any time other than during our hot rainy season, particularly during January to March. Formerly it was believed to be associated mainly with very wet seasons, but du Toit's work showed the absence of any correlation between the amount of rain and the incidence of the disease. His work did, however, indicate the existence of a distinct association with temperature, most cases occurring at or immediately after the maximum average temperature records of the period.

ANIMALS AFFECTED.

Sweating sickness is essentially a disease of calves, by far the greatest number of cases occurring in calves between the age of a few weeks to six months. Rare cases in older calves, even up to two years of age, have been recorded, and one case in an adult cow, aged approximately 3 years, developed in the stables of this laboratory. In connection with this case, however, it is essential to bear in mind that the animal was already in a very poor state of health, having not yet completely recovered from a very severe attack of malignant catarrhal fever, for which condition it had been under observation for the previous ten weeks.

SYMPTOMS.

These develop suddenly; a calf may appear to be perfectly normal one evening and then be found with pronounced symptoms of the disease next morning. In the first stage the characteristic feature is a dewiness over various portions of the surface, particularly in the neck, flank, base of ears, face, groin and shoulder regions. When the area over which sweating occurs is extensive, sometimes covering practically the whole body, the calf looks as though it has just come through a fine drizzle or heavy mist, the beads of sweat accumulating on the tips of the hairs and then coalescing together before trickling off. In this early stage there is usually a pronounced rise in the body temperature, temperatures of up to 108° F. being recorded. The calf looks dull, with drooping ears and arched back and is reluctant to move, and the skin of the affected parts is clammy, hot and extremely sensitive to the touch; even just laying the hand lightly on the back may cause the calf to crouch. Symptoms of dullness may be observed some hours before the sweating commences. Salivation and lachrymation are fairly pronounced, and if the mouth be opened the membranes will be found reddened. In some cases the mouth lesions are so severe as to cause the calf to champ and emit that smacking-of-the-lips sound so commonly described in cases of foot and mouth disease. The eye symptoms are very much the same as in the acute stage of ophthalmia. Appetite is impaired, probably due to the pain occasioned by the act of sucking, but cold water is frequently sought, probably owing to the soothing effect it has on the inflamed membranes. Other normal bodily functions such as urination, defaecation and respiration remain unaffected.

As the disease develops the temperature subsides and the active sweating ceases and is followed by falling out of the hair. The hair can easily be pulled out in tufts, held together by the fine surface layer of the skin itself, and the underlying skin is left red and raw. The bare skin, particularly if the calf has been unable to avoid exposure to the sun rays, becomes thickened and crusted, and extensive cracking may occur. A characteristic sickly sour smell comes from the skin, and this together with the crack wounds is evidently very attractive to screw-worm flies, as it is common for advanced sweating sickness cases to become screw-worm infested. The severity of the lesions of the skin and of the membranes of the mouth and nose may increase if the disease persists. In such cases ulcers and pseudo-membranous deposits develop in the mouth and nostrils, and in the latter accumulations may lead to obstructed breathing.

COURSE.

The disease usually runs a rapid course, death following in two to five days after the first symptoms. Deaths from complications, however, may occur much later. For example, although recovery from the acute stage might have progressed satisfactorily, chill through exposure and loss of hair or screw-worm infestation might prove fatal. Recovery is slow and it is frequently possible to pick out sweating sickness cases even months after the attack. Further, the disease furnishes a real set-back to development and the calf may remain unthrifty for months and so be permanently stunted.

POST-MORTEM FINDINGS.

Apart from the actual lesions described in connection with symptoms there is little to note in post-mortem examination, the internal organs generally being unaffected. Where death has been due to complications lesions of these will be evident. Microscopically, fairly characteristic changes can be discerned in the kidneys and very rarely small haemorrhagic spots on the surface of these organs may be visible to the naked eye.

TREATMENT.

From experiments both in Kenya and in this country it appears that the administration of liver preparations is decidedly beneficial, not only in preventing mortality, but also in cutting short the course of the disease and preventing the persistence of symptoms of unthriftiness. In Kenya a crude liver-extract is employed. A small quantity of this preparation, for the supply of which I am indebted to Mr. Hudson, of the Veterinary Laboratory, Kabete, was tried out here in 1938 and 1939 and gave very good results as far as these could be judged. In view of this no hesitation was felt in advising the use of the refined liver-extract, as used in human medicine, where the value of the calf justified the expense. Good results were reported with this. Subsequently arrangements were concluded with Messrs. Liebigs (Rhodesia) Limited, who very kindly prepared a supply of dried liver meal for trial, and since then a considerable amount has been issued free of charge to any persons applying for it, the only condition being that a report on the results of its use should be furnished. A fair number of reports has come to hand and almost without exception these have indicated that treatment has been beneficial.

In view of the above, treatment with liver preparations deserves pride of place. As in most diseases, the earlier treatment can be undertaken the more likely is it to be successful.

The method of treatment is simple and consists in dosing the calf with a watery suspension or solution of the equivalent of half a pound of fresh liver. When the extract is employed it must first be ascertained what its liver equivalent is—usually the dose required is in the region of ½ oz. The liver meal is arbitrarily considered to be equivalent to only twice its weight of fresh liver, i.e., 4 ozs. constitutes a dose. The dose of the liver preparation is mixed in a beer-bottleful of lukewarm water and given as a drench. This should be repeated in 24 hours and again 24 hours later if necessary. Frequently improvement has been reported after only one dose and, in fact, complete cure attributed to it, but usually not less than two doses should be given.

In Northern Rhodesia good results were reported to follow treatment with formalin, 10 c.c.'s of a 25% solution being injected intravenously in the early stage of the disease.

It will be appreciated that in a disease of this sort it is extremely difficult to assess accurately the value of any treatment, as not only is it impossible to produce artificially a number of cases at the same time and so be able to treat half and leave

the others untreated and then compare the results, but also the percentage mortality varies considerably in different outbreaks and even at different stages in the same outbreak.

Apart from the use of liver preparations, attention should be paid to general hygiene and nursing. The calf should not be exposed to rain or strong sunshine and should be kept under such conditions of housing as to minimise the chances of its becoming screw-worm infested. Local treatment of the skin during the acute sweating stage is useless, but application of oil or unsalted lard helps in the advanced stages where the skin requires softening. Milk will normally be the diet of affected calves, and any other foods fed should be soft so as not to aggravate the condition in the mouth.

PREVENTION.

Without an accurate knowledge of the cause or method of transmission of a disease it is impossible to take steps to prevent it, and apart from endeavouring to maintain calves in a sound healthy state there is nothing that can yet be recommended.

In two articles published in the Union it has been suggested that as calves of six months of age or less are the most susceptible and the disease is worst during the first three months of the year calving down should be arranged to take place in April, May and June. By so doing one would undoubtedly reduce the incidence of this disease, but it is doubtful whether such a policy would be generally practicable in this country.

Issued by the Tobacco Research Board of Southern Rhodesia.

The Tobacco Aphid.

DESTRUCTION OF WINTER HOST PLANTS.

By CHAS. K. BRAIN, M.A., D.Sc., Research Entomologist,
Tobacco Research Station, Trelawney.

IMPORTANT NOTICE TO TOBACCO GROWERS.

Investigations conducted at the Tobacco Research Station during the last two seasons indicate that the most important means of control of the Tobacco Aphid is likely to be the destruction of plants which carry the aphid through the dry season. This might appear to be a difficult task, but it is not so. The Tobacco Aphid agrees with the description of *Myzus persicae*, Sulz., a cosmopolitan insect which feeds upon a hundred or more different host-plants during the summer, but, in temperate climates, returns to peach trees during the winter. At least fifty of the recorded host-plants are to be found on, or around, the Tobacco Research Station. These include: Asparagus, Potato, Sweet Potato, Cabbage, Beet, Carrot, Antirrhinum, Ageratum, Cucumber, Castor-oil Plant, Canna and many others.

As a matter of fact the Tobacco Aphid has, as far as can be ascertained, only been found in this country on tobacco, cabbage (chiefly Savoys), turnip, radish, broccoli, potato, Gynandropsis and Cineraria. Green aphids which look something like Tobacco Aphid, except in the winged stage, have been found on Sonchus (sow-thistle) and a few native plants, but they are certainly not *Myzus persicae*, and what is more important, they will not feed on tobacco. It appears as though two strains of *Myzus persicae* occur in Southern Rhodesia, neither of which have ever been found on peach, which is the winter host in temperate climates. One form is found in gardens from December to March, most commonly on cabbage, radish, turnip and rarely on potatoes. This is never abundant on the Trelawney Research Station, and has never been found in the dry season. The other form appears to be restricted to tobacco in the growing season and to a plant grown in native compounds and used as a spinach during the rains and which often persists throughout the winter in places where the soils are moist enough.

DESCRIPTION OF PLANT.

This plant is *Gynandropsis pentaphylla*, which the natives know as RUNI, TSUNA or NYEVE. It is an erect, much branched annual with a long tap-root. It is usually about two feet high, but it may vary from a few inches to three feet in height, and about the same across the branches. The stems are pale green, or green marked with purplish brown, or occasionally

all purple. The lower leaves are normally two to four inches long, with five, or rarely seven oval leaflets all from the top of the stalk, which is usually about as long as the leaflets. The whole plant is more or less thickly covered with short glandular hairs which make it sticky to the touch. Higher up the branches the leaves are very small, with three leaflets and no stalk. The flowers and pods are on long thin stalks. The flowers are not very large; the sepals are green, and the four white petals are curled backward. The six yellow stamens are projected from the flower on thread-like purple stalks. The pods are from three to four inches long and less than a quarter of an inch thick, and each contains from eighty to ninety seeds. The seeds when ripe are curved, blackish and very rough. It is estimated that an average plant produces eight to ten thousand seeds in a season. Occasionally plants are found with thickened and distorted stems and very small, twisted leaves. It is not yet known if this condition is due to a virus disease, nor whether it is associated in any way with any disease in tobacco.

Gynandropsis pentaphylla apparently occurs throughout Africa north of the Transvaal and Bechuanaland, and also in India and Ceylon. At the present time, mid-June, there are plants in full flower and seed in the compound on this Station, and also in the majority of compounds between here and Banket. Last year, towards the end of August, fresh plants were also found in this compound, but the aphids at that time were apparently all in the fourth stage, i.e., they have to moult once again before they are adult females and can themselves produce living young. This seems to suggest that the end of the winter may be spent by hibernating fouth-stage aphids. This stage may be recognised by the facts that the colour is slightly paler and the hind tibia is only a little more than half the length of that of the adult.

It has been found that plants of *Gynandropsis* which at first sight appeared to be dead had put out a few small clusters of very small pale leaves which were found to be covered with aphids. A careful search of the vegetable gardens at the same time failed to reveal *Myzus persicae* on any of the cabbage, turnips, tomatoes, etc., although bean aphid and the mealy cabbage aphid are present in large numbers.

From the following facts, which have been established on the Research Station, it is apparent that the control of Tobacco Aphid in lands, by spraying or dusting, is impracticable and uneconomic, if not impossible.

1. To spray an acre of half-grown Virginia tobacco thoroughly takes from 750 to 1,250 gallons of spray material The operation is difficult because the aphids are on the undersides of the leaves, or on the "frills" of the leaves.

2. To obtain satisfactory results an oil emulsion such as Alboleum must be added to the Nicotine, at the rate of Alboleum one gallon and Nicotine Sulphate (40 per cent.) to 400 gallons of water. Soap instead of oil emulsion does not give such good results.

3. Any spray strong enough to kill the adult aphids will cause some damage to the leaves, although this may not be evident for a week or more.

4. Dusting with ordinary commercial dusts invariably gave very unsatisfactory results with Tobacco Aphids.

5. Spraying or dusting is detrimental to the Syrphid-fly larvae which destroy the aphids and which constitute the most valuable natural control known.

In view of these conclusions it is obviously imperative to take every possible precaution to reduce the initial infestation of the tobacco lands by aphids. Normally this initial infestation, which usually occurs two or three weeks after planting out, is small and scattered. This would be expected to be the case, as tobacco aphids have not been found on any wild veld plant. During the last two seasons on this Station it is estimated that all the winged aphids concerned in the initial infestation of our land could have been produced on any one of the *Gynandropsis* plants in our compound in their present condition.

RECOMMENDATION.

GYNANDROPSIS is well known to natives by the native names already given, but Nyasa boys always use the name Run, Runee. *It is obvious that the greatest care should be taken to have all plants destroyed throughout the winter, not overlooking those which, on first appearance, might look dead.*

The cultivated plant known as Cleome, which is often grown in flower gardens because of its showy pink heads of flowers should certainly not be grown on tobacco farms during the winter. This is *Gynandropsis speciosa*, very closely related to the plant with which we are concerned. *Myzus persicae* was found on this plant in the Municipal Gardens, Salisbury, on May 24th this year.

RECIPE.

Take a good earful of cleanliness propaganda, digest it, add a measure of common sense to suit your own farm conditions, and put in some effort. This will give you a cup of joy in the form of better crops and storage conditions.

If the result is only half baked, double your effort.

Cleanliness Aids Insect Control.

The Construction of Dipping Tanks.

By B. G. Gundry, A.I.Mech.E.; and Notes on their Management, by J. M. Sinclair, M.R.C.V.S., Chief Veterinary Surgeon.

Since the building of a dipping tank is not likely to be attempted by a novice with no previous knowledge of building, it is not intended, in this article, to describe all the details of the operations involved, but rather to provide such particular information as will enable farmers or others with some experience of building in the materials they propose to use, either to perform this rather exceptional job themselves or to supervise the work of a native or European contractor.

Selection of Site.—Great care should be taken in selecting a suitable site for the erection of a dipping tank.

The site must be well drained and the soil firm and compact. A sand, gravel or schist formation is most desirable. Ground liable to become swampy or water-logged should be avoided. The ground should, if possible, have a slight uniform slope so that it is well drained and there is no difficulty in arranging that the floor of the dripping pen, which is placed at the higher end of the tank, may slope in the direction of the tank. If such a slope is not available the soil removed from the excavation should be used to build up the floor of the dripping pen to the proper height and slope.

A permanent supply of clean water from a river, borehole or well is necessary, and this supply should be definitely provided before work on the tank is commenced, especially if the sinking of a well or borehole is to be undertaken.

Materials.—Dipping tanks may be built of concrete, plain or reinforced, masonry or well burnt bricks.

In most cases there is some deciding factor which determines which of these materials can be most economically used on any particular site. Where good building stone, such as granite, dolorite or other crystalline igneous rock, is available, a masonry tank is probably the cheapest. If bricks are used they must be really sound and very well burnt. Lightly burnt and friable bricks are useless for this purpose.

Testing.—When a dip tank has been completed and filled for the first time it is not always an easy matter to decide whether it is sufficiently water-tight or not. During the first twenty-four hours after filling, the level of the water may fall by as much as three inches; this is due partly to evaporation, but chiefly to the absorption of the water by the concrete or plaster. If the tank is again filled to its full capacity the loss should be very considerably less during the subsequent twenty-four hours if the work is reasonably sound, and after three or four days there should be no loss apart from evaporation, which may vary from

practically nothing in cool humid weather to as much as ¼ inch in twenty-four hours in hot dry windy weather. Any loss in excess of this amount will indicate a leakage either through a definite crack or through porous plaster or concrete. The remedy will depend on the nature of the defect. A coating of some bitumastic solution such as 1 lb. pitch to 1 gallon of tar boiled together and applied hot with a stiff brush or some proprietary solution made specially for such purpose may be found necessary in the event of the structure proving porous. Cracks will require special treatment according to their nature and extent.

Calibrating the Tank.—For the purpose of being able to adjust the strength of the dipping fluid from time to time, it is most important that the actual quantity of fluid in the tank can be readily determined. The most satisfactory method of calibrating a tank is to measure the water required to fill it by means of a small tank of known capacity of, say, 100 to 200 gallons.

When the level of the water in the tank has risen to about 5 feet—the quantity required to reach such a level having been carefully noted—a measuring stick, preferably a hard wood plank, about 10 feet long, is stood vertically on the bottom of the tank, and as each succeeding 100 gallons of water is added the new level is marked on the stick by means of a shallow saw cut, with the corresponding number of gallons marked against it by scratches or punch marks. This operation is continued until the tank is full. An alternative method is to first graduate the stick in feet and inches, and with this, measure and record the depth corresponding to each addition of water.

If the former method is used the marks on the stick should be measured and recorded in some safe place, so that in the event of loss or damage to the stick itself a new one can be made. The full capacity of the tank as illustrated is 4,170 gallons.

The measuring tank is also used subsequently for proportioning the dip fluid when making up the dip to the proper strength or level.

The water should be pumped or delivered into the measuring tank and from there led into the dip tank by means of a pipe. The concentrated dip should be added separately and not be mixed in the measuring tank unless it is constructed of some non-corrosive material.

Roof.—The provision of a roof over the dip tank is strongly advocated, as it diminishes considerably the variation of the strength of the fluid by evaporation or the addition of rainwater. An ordinary pole and thatch roof is all that is actually necessary, but a more permanent and neater roof can be constructed of corrugated iron as shown in Fig. I. The iron can be obtained rolled to any curvature at a small extra cost, and the minimum amount of imported timber is required.

In the drawing a distance of 6 feet is allowed between the ledge of the tank and the beams of the roof, but if this amount of head room is considered unnecessary, the height of the roof may be decreased accordingly.

Dripping and Collecting Pen.—The provision of a properly constructed dripping pen is essential in order to save a very big

loss of dipping fluid. A triangular pen immediately adjacent to the outlet of the tank is strongly recommended in preference to the long paved "walk" sometimes advocated.

The floor of the pen should be of concrete or stone; ordinary farm-made bricks will not stand up to the work by themselves, and the amount of cement required to plaster them sufficiently thickly to make them serviceable would be better employed in the making of a true concrete floor. The stones in a masonry floor should be flat and as large as possible up to 2 or 3 square feet in area. They should be carefully bedded down with a space of about ½ inch between adjacent stones. These spaces are afterwards filled in with a grouting mixture of 1 part cement and 5 parts sand. The edges of the stones should first be cleaned and the ground beneath moistened by pouring water into the joints. The grout must then be thoroughly worked in with a small trowel. The floor should have an even surface and slope down from the three sides towards the tank with a fall of at least 1 in 50 so that the drippings from the cattle will flow back to the tank fairly rapidly. If the pen is to be enclosed by a fence only, a low kerb should surround the floor.

Where plenty of stone is available a heavy masonry wall is the best method of enclosing the dripping pen, particularly in cold and windy situations, as it affords some protection to the cattle and it is also more permanent than a wooden fence. The stones may be laid in lime mortar or even dagga, in which case the joints should be raked out to a depth of at least 1 inch, wetted, and pointed with 1 to 4 cement mortar. In either case the top of the wall should be finished off with a cement plaster capping to prevent rain entering the joints. Such a wall should be about 2 feet wide at its base and 1 foot wide at the top, and 4 feet 6 inches high. An example of "squared rubble" masonry is illustrated in Fig. II. This type of bond is recommended as being far stronger than "random rubble," which too often becomes a mere pile of stones, having neither strength nor stability. The size of the dripping pen will depend on the size and number of cattle which have to be dipped in a day. A fair average allowance is 12 square feet per head. When large herds have to be handled considerable economy in time can be effected by erecting a central fence to divide the pen into two halves, and a gate or slip rails are arranged as shown in Fig. I. This arrangement allows the animals in one half of the pen to drip while the other half is being filled, when the first batch is released and so on.

A small gulley must be made between the top of the outslope of the tank and the dripping pen. An iron pipe should be set in the wall of the tank to carry rain water which falls in the dripping pen from this gulley, clear of the tank. The diameter of this pipe should be proportionate to the size of the dripping pen; a 3 inch pipe will be sufficient for the size of pen shown in the drawing. A second pipe is set to lead the fluid returning from the dripping pen back into the tank. When dipping is in progress this pipe is left open and the rain water pipe closed; at other times conditions are reversed, the rain water pipe only being left open. A stick or piece of sacking is sometimes used to close these pipes, with the result that they are apt to become

accidentally stopped up. A better plan is to fit a screwed socket to the end of each pipe in which a standard screwed plug can be used as a stopper.

The step or ridge between this gulley and the tank should be at least 7 inches high to ensure that during a heavy storm the rain water does not overflow into the tank.

The collecting pen can be of any desired size according to circumstances, and may be fenced, with stout posts or rails, or surrounded by a masonry wall.

It is advisable to fence off the entire site of the dip to prevent stray animals from licking any dried arsenic which is always liable to accumulate round a dip in sufficient quantities to prove extremely dangerous.

It is also advisable to provide a trough from which the cattle may drink before being dipped, as thirsty animals may attempt to drink the dipping fluid as they pass through.

Cement Mixtures.—Since the use of cement enters largely into the construction of all the dipping tanks described herein, a general summary of the more important points to be observed in its use is given here, as they apply with equal importance to all cement mixtures referred to subsequently, but for more complete information the reader is referred to Bulletin No. 588, "Concrete on the Farm."

The cement itself should be obtained as fresh as possible; it deteriorates on keeping over-long even in a comparatively dry store.

Only clean, sharp sand should be used with cement. It should be fairly coarse and must be free from organic matter, earth, clay and dust. Such impurities, if unavoidably present, must be removed by washing the sand.

The aggregate for concrete must consist of hard, clean, angular stone such as granite, quartz, quartzite or diorite; all oxidised or soft pieces must be discarded. Sandstones and shales must not be used.

The stone must be broken down to various sizes, varying from the maximum size specified for the particular job down to quite small pieces.

All water used must be clean and free from excessive quantities of dissolved impurities.

All cement mixtures, by which is meant mortars, plasters and concrete, should be carefully proportioned by means of suitable measuring boxes or tins. Careless measuring must result either in a weak mixture or a waste of cement.

The mixing must be carried out on an impervious platform of wood or iron, free from cracks and holes through which the cement can run to waste, or on a brick floor laid on a level piece of ground and grouted with a mixture of 1 part cement to 6 parts sand.

The mixing must be carried out systematically. The sand should be measured out and spread in a thin layer, over which

the cement is then sprinkled. These should be mixed thoroughly while dry by being turned completely over from one end of the platform to the other at least twice, and the mixing board should be sufficiently large to permit this to be done.

In making concrete the aggregate may be added dry and mixed at the same time with the cement and sand, or it may first be wetted and added to the cement and sand after they have been already mixed, in which case the water must be added to the whole and the mixing be proceeded with immediately.

The water should be added gradually as the mixing proceeds, by means of a watering can fitted with a fine rose, and care should be taken not to add too much water towards the end of the operation, as it will be found that at this stage the mixture appears to become much more moist by the continued action of mixing alone, owing to the better distribution of the water. Only sufficient water should be added to make the mixture workable; any excess of water decreases the eventual strength of the mixture.

The mixing of cement should never be left to unsupervised natives; sooner or later they will "let you down" in one way or another.

The setting of cement, which is a chemical reaction, commences very shortly after it becomes moistened, and the longer it is worked after setting has commenced, the weaker the final product will be. It follows, therefore, that the mixing and placing of the mixture should be completed as quickly as possible Each batch should be placed and left undisturbed within 30 minutes from the time the water is first added to the mixture, and the sizes of the batches should be limited to enable this to be done.

Plastering should be done quickly and continuously. Native builders are inclined to spend much too long attempting to obtain a good finish, thus imperilling the durability of the plaster.

Any surface which is to be plastered must be washed or brushed free of all dust and loose particles, and wetted before the plaster is applied.

Immediately cement work has set it must be protected from the drying action of wind and sun by being covered with sacks or grass, which must be kept wet continuously for at least seven days. This process, known as "curing," is absolutely essential if satisfactory results are to be obtained.

In order to render cement mixtures (particularly plaster, mortar and grout) less harsh to work, a proportion of lime paste is sometimes added. Not only does it make the mixture more workable, but renders it more waterproof. The lime paste is prepared by soaking quick lime in water **for at least two weeks,** and then straining it through a fine sieve to remove any solid particles which may not have decomposed and which, if included in the plaster, may burst out and ruin the job. The lime paste is mixed to a thin cream and added to the other ingredients with the first mixing water.

There are numerous special preparations on the market for adding to cement mixtures in order to render them waterproof,

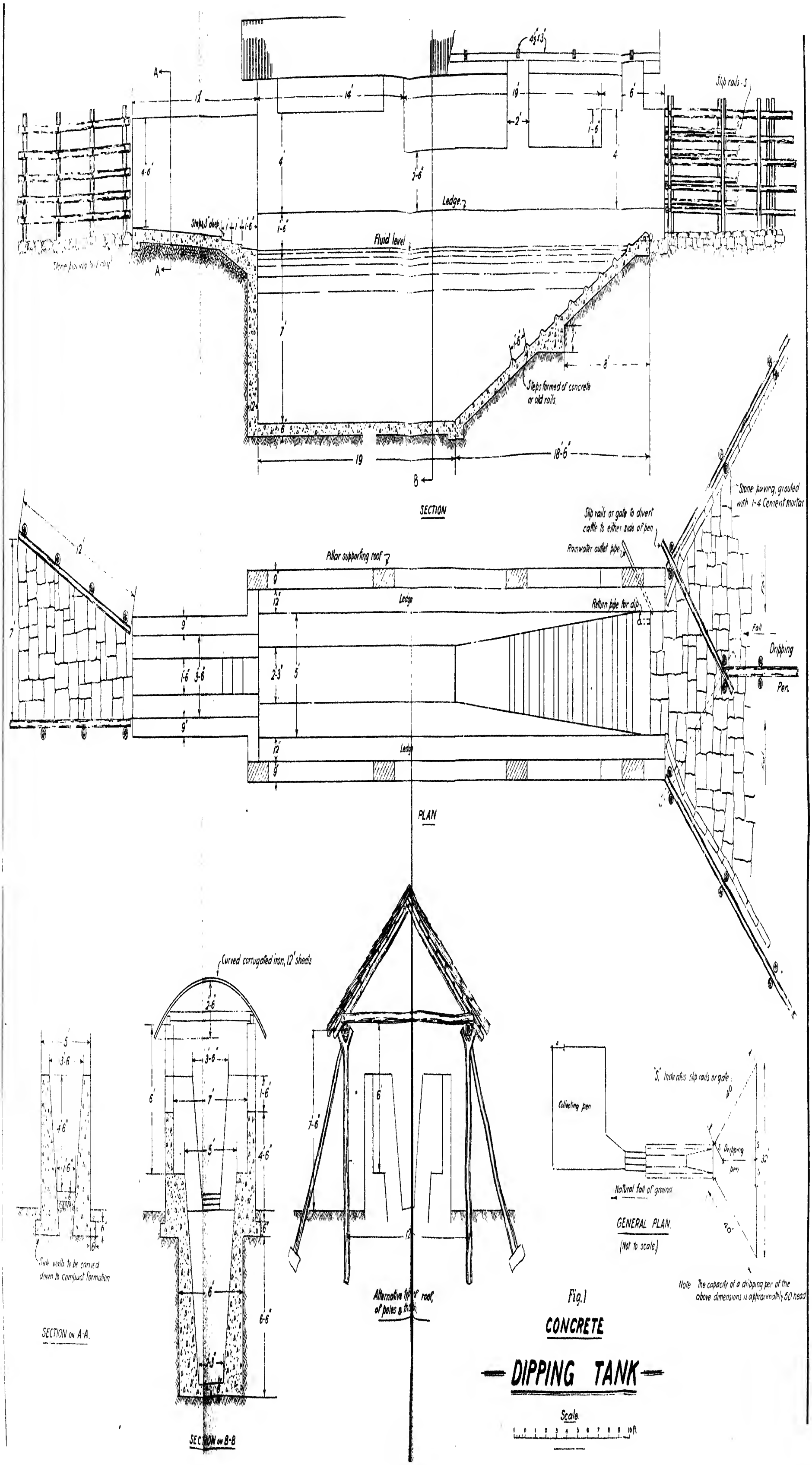


Fig. 1

CONCRETE

DIPPING TANK

the cement is then sprinkled. These should be mixed thoroughly while dry by being turned completely over from one end of the platform to the other at least twice, and the mixing board should be sufficiently large to permit this to be done.

In making concrete the aggregate may be added dry and mixed at the same time with the cement and sand, or it may first be wetted and added to the cement and sand after they have been already mixed, in which case the water must be added to the whole and the mixing be proceeded with immediately.

The water should be added gradually as the mixing proceeds, by means of a watering can fitted with a fine rose, and care should be taken not to add too much water towards the end of the operation, as it will be found that at this stage the mixture appears to become much more moist by the continued action of mixing alone, owing to the better distribution of the water. Only sufficient water should be added to make the mixture workable; any excess of water decreases the eventual strength of the mixture.

The mixing of cement should never be left to unsupervised natives; sooner or later they will "let you down" in one way or another.

The setting of cement, which is a chemical reaction, commences very shortly after it becomes moistened, and the longer it is worked after setting has commenced, the weaker the final product will be. It follows, therefore, that the mixing and placing of the mixture should be completed as quickly as possible Each batch should be placed and left undisturbed within 30 minutes from the time the water is first added to the mixture, and the sizes of the batches should be limited to enable this to be done.

Plastering should be done quickly and continuously. Native builders are inclined to spend much too long attempting to obtain a good finish, thus imperilling the durability of the plaster.

Any surface which is to be plastered must be washed or brushed free of all dust and loose particles, and wetted before the plaster is applied.

Immediately cement work has set it must be protected from the drying action of wind and sun by being covered with sacks or grass, which must be kept wet continuously for at least seven days. This process, known as "curing," is absolutely essential if satisfactory results are to be obtained.

In order to render cement mixtures (particularly plaster, mortar and grout) less harsh to work, a proportion of lime paste is sometimes added. Not only does it make the mixture more workable, but renders it more waterproof. The lime paste is prepared by soaking quick lime in water **for at least two weeks,** and then straining it through a fine sieve to remove any solid particles which may not have decomposed and which, if included in the plaster, may burst out and ruin the job. The lime paste is mixed to a thin cream and added to the other ingredients with the first mixing water.

There are numerous special preparations on the market for adding to cement mixtures in order to render them waterproof,

and their use can be recommended, especially for the plastering of the inside of the tank itself, where added security is considered desirable. The special instructions supplied by the makers should be carefully followed.

A Concrete Dipping Tank (Fig. I.)—**Construction.**—The excavation for the tank must be taken out to the neat dimensions shown in the drawing. Particular care must be taken to see that the shelf for the side walls is cut down until the formation is thoroughly compact.

The bottom and outslope should be tamped all over to ensure that there are no soft spots. The formation should be uniform throughout; should there be any variation there is a danger of uneven settlement and consequent cracking of the concrete.

The concrete used throughout should consist of 1 part cement, 3 parts sand and 6 parts aggregate. For the floor and thinner parts of the walls the aggregate must be crushed to pass a 1 inch diameter ring, and, for the heavier section, a $1\frac{1}{2}$ inch ring.

The floor and outslope should be laid first over the whole width of the excavation. Particular care should be taken in laying the outslope to ensure that the concrete is absolutely solid and water-tight. It may be found advisable to reduce the quantity of stone to 5 or even 4 parts if any difficulty is experienced in this respect.

The steps must be moulded as the work proceeds, and not stuck on afterwards. When this work is completed, the form work for the walls may be erected. This will consist of "V"-shaped frames constructed of 3 inch x 2 inch timber, which must be carefully aligned and held rigid by cross pieces extending well beyond the sides of the excavation and secured to pegs driven into the ground.

The actual forms should consist of 9 inch x $1\frac{1}{2}$ inch planks planed smooth on their inner face and placed 3 or 4 deep all round.

The legs of the "V"-shaped frames should be held apart at the bottom by loose wedges so that when these are removed the planks are freed and can be raised without damaging the concrete.

The concrete must be laid in continuous layers not exceeding 12 inches in thickness extending all round the tank. Two such layers at least should be completed each succeeding day until the level of the ledge is reached. All materials should be ready at hand so that the work of laying the concrete and applying the plaster can be completed in the shortest possible time.

It will be found that a scum of impurities forms on the surface of each layer of concrete as it sets. This must be scraped off until a clean rough surface of stone and sand is exposed. This surface should be given a thin wash of 1 part cement and 1 part sand immediately before the new concrete is placed above it.

As soon as the final layer is sufficiently set, the form work should be removed and the interior surface of the concrete roughened where necessary with some sharp steel implement preparatory to plastering. The plaster, which must be applied in a single coat not less than $\frac{1}{2}$ inch thick, should consist of a mixture of 1 part cement, 3 parts sand and $\frac{1}{2}$ part lime paste—

prepared as directed under the heading of "Cement Mixtures." The surface of the walls must be thoroughly wetted before the plaster is applied, and every effort should be made to complete the plastering in one day. A smooth surface should be obtained by a final polish with a steel float, but this process must not be overdone, or fine hair cracks may develop. When finished, it must be cured as previously described for at least seven days.

The placing of the concrete walls above the ledge can now be proceeded with. Whether these walls are afterwards plastered or left more or less rough is a matter of personal choice. A plaster consisting of 1 part cement, 5 parts sand and ½ part lime paste will be found suitable for the purpose, but the surface must be first roughened and wetted as previously described.

The tank may be filled as soon as convenient after the internal plastering is sufficiently set.

Concrete Dipping Tank: Quantities of Materials.

Item.	Section.	Length.	No. of.	Total Quantity
Cement	—		—	264 pockets.
Sand	—		—	30 cu. yds.
Stone	—	—		54 cu. yds.
Lime	—		—	3 bags.
Roof:—				
Bearers	4½ in. x 3 in.	14 ft.	4	56 ft.
Bearers	,,	14 ft.	2	28 ft.
Tie beams	,,	8 ft.	7	56 ft.
Corrugated iron	24 G.	12 ft.	22	264 ft.
Roofing screws	—	2½ in.	—	1 gross

The above quantities of cement include sufficient for the pillars supporting the roof, but if these are not required, the quantity can be reduced by 6 pockets. If the walls above the ledge are to be plastered —both inside and outside—a further 10 pockets will be required. Sufficient lime is provided for all plastering.

Those who have had sufficient previous experience in this class of work may prefer to adopt what is really a sounder method of construction, but which requires more skill and judgment; that is, to cast the concrete below fluid level so that it is sufficiently compact and dense that plastering is unnecessary. This may be achieved by making the following modifications: The concrete mixture should be 1 part cement, 3 parts sand and 5 parts stone and ½ part lime paste. The aggregate must be very evenly graded, and special care must be taken in punning the concrete as it is laid, and to obtain a smooth surface it should be spaded away from the shuttering. This mixture will, of course, require a larger proportion of cement, but this can be balanced by reducing the thickness of the walls below fluid level at the discretion of the builder.

A MASONRY DIPPING TANK (Fig. 2).

Where suitable building stone is abundant a masonry dip tank can be built far more cheaply than one of concrete, especially where the quarrying, dressing and carting of the stone can be

made a spare time job for natives, who, for various reasons, have to be kept on the pay roll but cannot always be profitably employed.

Preparation of Stone.—In many localities granite or dolorite can be found in the form of slabs or layers of varying thickness that have split off large bodies of rock. These can be cut into suitable size blocks. Where it is necessary to split large bodies of rock the following method is usually employed. A line of holes about 1 inch diameter and 3 to 5 inches in depth is drilled with a jumper at intervals of 4 to 8 inches along the line of cut. Into each of these holes is placed a steel wedge or "feather" with its larger end at the bottom of the hole. A tapered steel plug is then driven in beside the feather with a heavy hammer. All the holes are plugged in this way in the afternoon when the rock is comparatively warm. During the night the rock cools down, contracts and splits along the line of holes. Some experience is required, however, to determine the direction of the grain, or planes of cleaverage along which the rock will split most easily.

The size of the blocks used may vary considerably, the weight that can be conveniently handled being really the limiting factor. A stone 18 inches long by 9 inches wide and 6 inches thick weighing about 100 lbs. would be a very fair maximum.. Stones less than one-third of this size should only be used occasionally where necessary for filling in between the larger ones. It will be readily appreciated that less cement will be required to lay large well-shaped stones carefully fitted together than small or ill-shaped ones requiring large quantities of mortar to fill very numerous or ill-shaped joints.

Excavation.—The excavation must be taken out to the exact dimensions shown in the drawing, so that no back filling behind the masonry is necessary. The floor and outslope must be rammed all over to ensure that there are no soft spots. The shelves on which the foundation of the splash walls rest must be cut down until a thoroughly compact formation is reached. If a sound footing cannot be found at a reasonable depth it may be advisable to complete the walls of the tank itself and build the splash walls independently so that if they do subside no damage will be done to the former.

Construction.—Great care should be exercised in selecting the stones for the floor and outslope, which must be laid first. They should be of uniform thickness of about 6 inches, and as large in area as possible. They must be laid on a thin layer of sand, and each stone must be hammered all over with a small wooden log until it is absolutely rigid.

A space of about half an inch should be left between adjoining stones. A liquid grout of 1 part cement and 4 parts sand should afterwards be poured into these joints until they are half full, and the remainder of the spaces immediately filled by working in a stiffer mixture of 1 part cement and 3 parts sand with a small trowel.

The side and end walls should be laid hard up against the face of the excavation, but where, for any reason, this cannot be done, any spaces left must be carefully filled in with sand and tamped solid as the work progresses.

In the drawing, the sides of the excavation are shown vertical, but there is no objection to cutting them to the same slope as the inner face of the wall and making the stone work a uniform thickness of 18 inches throughout to the level of the footing of the ledge.

The type of bond recommended for the walls is known as "squared rubble," and is illustrated in the drawing of the wall of the dripping pen in Fig. 2.

It will be noted that the upper and lower edges of each stone are parallel and are laid horizontally and the vertical joints are kept as short as possible. The bonding across the thickness of the wall is most important, and either "through bonds," extending from one side of the wall to the other, or "headers" extending about two-thirds of the way through the wall and crossing each other alternately from opposite sides should be laid 4 or 5 feet apart in each course. The practice of dressing off the ends of these or any other stones after they are laid should not be permitted. Each stone must be laid on its natural bed, i.e., with its grain or natural lamination lying flat.

The walls must be properly bonded throughout their thickness. Some builders are content to lay the face of the wall with proper bonds and fill in behind in a careless and haphazard manner. Such methods should not be tolerated in a job of this sort.

The progress of the walls should proceed uniformly, the height of no single portion exceeding the remainder by more than 2 feet.

All the walls of the tank itself, up to the level of the ledge, should be laid in cement mortar consisting of 1 part cement, 4 parts sand and ½ part lime paste. In order to avoid delay in using each batch of mortar all the stones for each course should be selected, dressed and fitted first before the mortar is mixed; the actual laying is then a straightforward job. The splash walls above the ledge and the walls of the entrance race may be built in ordinary lime mortar or even dagga, provided the joints are all properly pointed with cement mortar. The foundations of the walls of the entrance race should in either case be laid in lime mortar, to which about 10 per cent. of cement has been added immediately before use.

Plastering.—If a tank is built with large well-shaped stones and the faces of the walls are evenly finished and the joints are properly made with the mixture recommended, it is not necessary to plaster the interior of the tank. If, on the other hand, comparatively small stones are used and the joints are consequently numerous, plastering is advisable to ensure water tightness. Cement does not adhere too readily to a stone surface, and it is very advisable to rake out the cement joints in the masonry to a depth of 1 inch to provide keys for the plaster. This must be done as the work proceeds, since the mortar will have set too

hard to remove later. The plaster used below the level of the ledge should consist of 1 part cement, 3 parts sand and ¼ part lime paste. For plastering the splash walls above the ledge and the walls of the entrance race a mixture of 1 part cement, 5 parts sand and ½ part lime paste may be used. All the plastering must be applied in one coat not less than ½ inch thick, and the interior of the tank itself should be completed in one day. The plaster should be worked to an even surface with a wooden float and given a final polish with a steel trowel or float, but this operation must not be overdone, or hair cracks may develop. The plaster must be carefully cured as previously described. The tank may be filled as soon as convenient after the plaster is sufficiently set.

MASONRY DIPPING TANK.

Quantities of Materials.

Item.	Description.	Quantity.
Stone	For building tank only up to level of ledge	49 cu. yds.
Stone	For splash walls and walls of entrance race	20 cu. yds.
Cement	For laying masonry in tank up to level of ledge in cement mortar (1 cement, 4 sand, ½ lime paste)	98 pockets.
Sand	For ditto	15 cu. yds.
Cement	For plastering interior of tank to level of ledge in cement mortar (1 cement, 3 sand, ¼ lime paste)	16 pockets.
Sand	For ditto	2 cu. yds.
Cement	For laying splash walls and walls of entrance race in cement mortar (1 cement, 5 sand, ½ lime paste)	32 pockets.
Sand	For ditto	6 cu. yds.
Cement	For plastering splash walls and walls of entrance race with cement plaster (1 cement, 5 sand, ½ lime paste) ..	12 pockets.
Sand	For ditto ..	2½ cu. yds.
Lime	For adding to cement mixture for all above work	13 bags.
Alternative—		
Lime	For laying splash walls and walls of entrance race in 1-6 lime mortar	7 bags.
Sand	For ditto ...	6 cu. yds.

The above estimate for the quantity of cement required for laying the stonework is based on fair average workmanship and regular joints.

A BRICK DIPPINK TANK.

(See Special Section, Fig. 2.)

Most of what has already been said regarding the building of a masonry tank applies with equal force to the building of a tank in brickwork.

The same care must be exercised in making the excavation. The bricks should be laid and plastered with the same mixture. The inside dimensions are the same and only minor alterations in the external dimensions are shown in the special section of a brick tank. (Fig. 2.)

Only really sound, thoroughly well-burnt bricks are suitable for such work. To make a rough test of their suitability, soak a few of the bricks in water for at least 24 hours. At the end of this period, although they will have absorbed a considerable quantity of water, they should not show the slightest signs of disintegrating, and they should break with only slightly less effort than when dry.

The use of bricks, however good, is not recommended for the floor of the tank, and still less so for the outslope. Unless sufficient stone is obtainable to lay the floor as directed in the case of a masonry tank, concrete should be used for this purpose.

The first two courses of the brick walls should be laid along either side of the excavation so that a space of 3 feet is left between them in which the concrete floor is laid. Two planks can be used as shuttering to retain the concrete floor on the outslope, or two courses of brickwork may be laid temporarily either dry or in dagga to serve the same purpose. The width of the concrete at the top of the outslope will be 5 feet 9 inches.

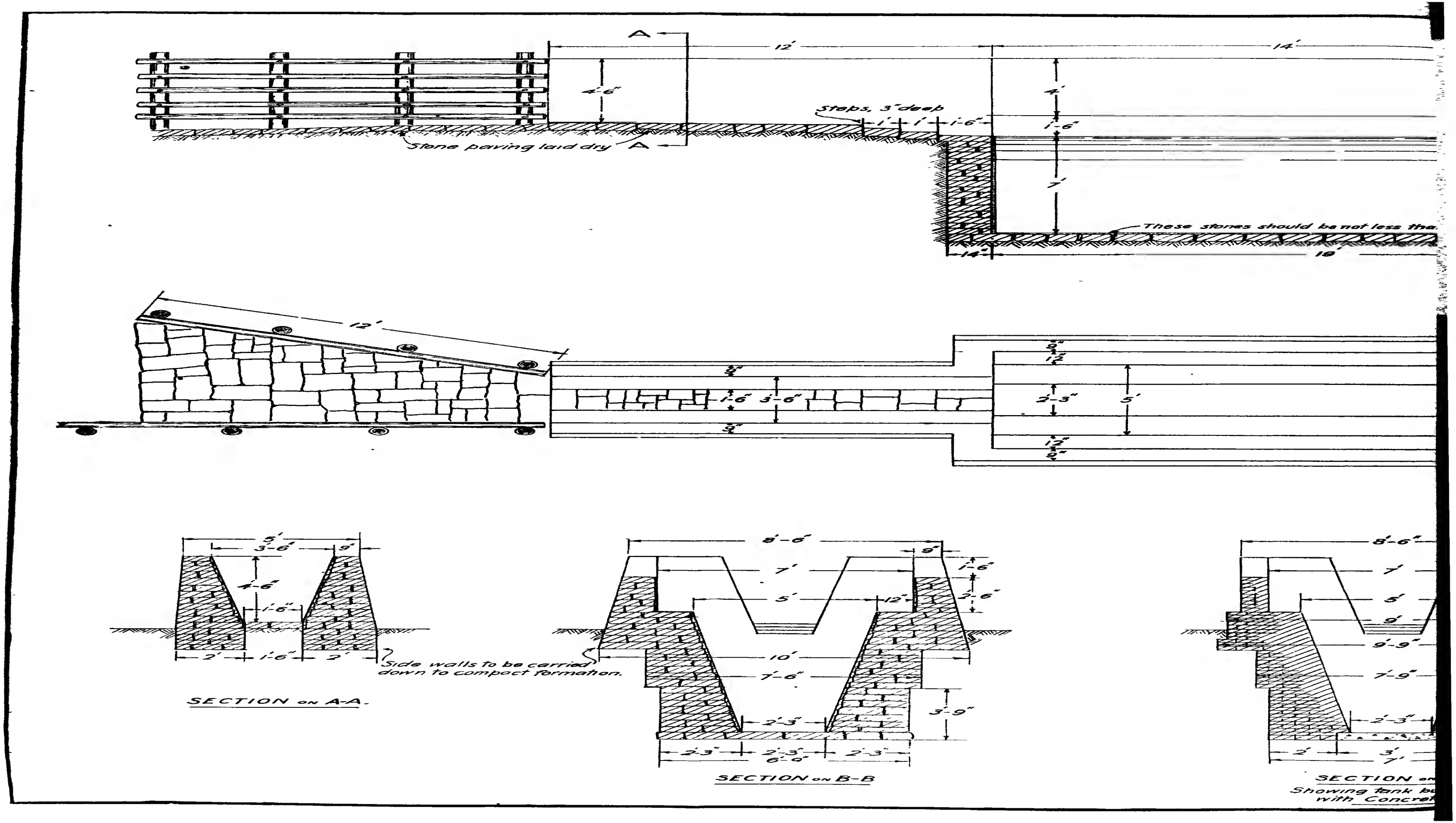
As soon as the floor has set, the walls of the tank can be built, the bricks being laid in alternate courses of headers and stretchers. All bricks must be soaked in water for at least 5 minutes immediately before being laid.

In the drawing, the sides of the excavation are shown vertical but, if preferred, they may, as mentioned in the case of the masonry tank, be excavated on the slope to the same angle as the inner faces of the walls and the brickwork kept at a uniform thickness of 18 inches throughout. If this is done the courses of brickwork should be kept horizontal, but staggered or stepped back so that the outer bricks are all hard up against the face of the excavation. The objection to this method of building is that far more care and skill are required in making the excavation exactly the correct shape and size, since it is important that no back filling be necessary.

The splash walls may be laid in lime mortar or dagga, but, in either case, they must be plastered, at least on the inside.

Since bricks are porous the water-tightness of the tank depends entirely on the plaster, and it is advisable to make the coating not less than ¾ inch thick.

The walls must be cleared of all loose dirt and particles of mortar and well wetted before the plaster is applied. Careful curing of the plaster is essential.


A
12'
14'
4'-6"
4'
1'-6"
7'
Steps, 3" deep
1' 1' 1'-6"
Stone paving laid dry
These stones should be not less tha
14"
19'
12'
9"
1'-6"
3'-6"
2'-3"
5'
12"
5'
3'-6"
9"
4'-6"
1'-6"
2'
1'-6"
2'
Side walls to be carried down to compact formation.
SECTION on A-A.
8'-6"
9"
1'-6"
2'-6"
7'
5'
12"
10'
7'-6"
3'-9"
2'-3"
2'-3"
6'-0"
SECTION on B-B
8'-6"
7'
5'
9'
9'-9"
7'-9"
2'-3"
2'
3'
7'
SECTION on
Showing tank bu
with Concre

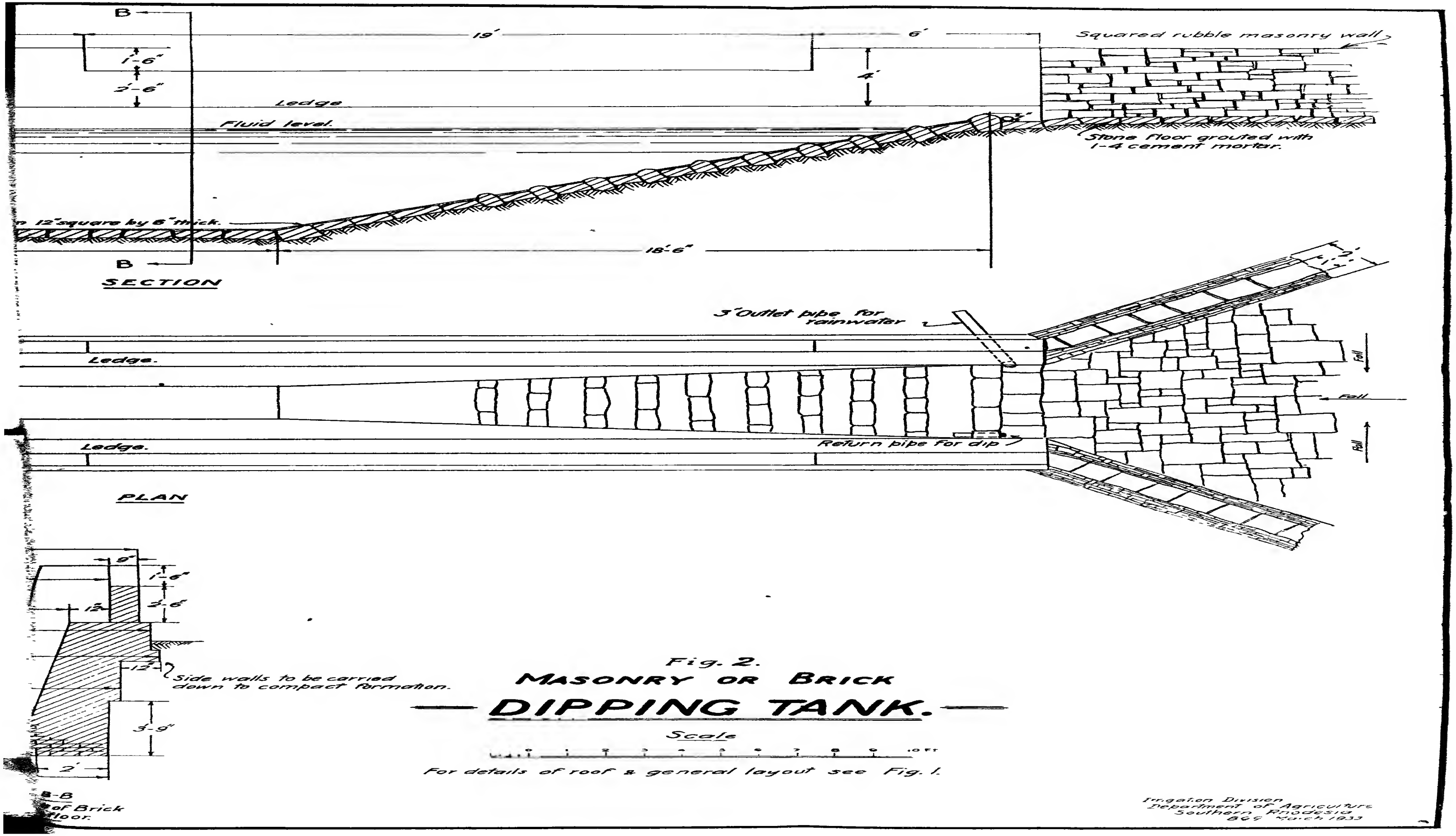


Fig. 2.

MASONRY OR BRICK

DIPPING TANK.

For details of roof & general layout see Fig. 1.

BRICK DIPPING TANK.

Quantities of Materials.

Item.	Description.	Quantity.
Bricks	For building tank only up to level of ledge	16,500
Bricks	For splash walls and walls of entrance race	5,800
Cement	For laying all brickwork in tank up to level of ledge in cement mortar (1 cement, 4 sand, ½ lime paste)	92 pockets.
Sand	For ditto	14 cu. yds.
Cement	For plastering interior of tank as above with cement plaster (1 cement, 3 sand, ¼ lime paste)	16 pockets.
Sand	For ditto .	2 cu. yds.
Cement	For laying splash walls and walls of entrance race in cement mortar (1 cement, 5 sand, ½ lime paste)	26 pockets.
Sand	For ditto	5 cu. yds.
Cement	For plastering splash walls and walls of entrance race with cement plaster (1 cement, 5 sand, ½ lime paste)	12 pockets.
Sand	For ditto	2½ cu. yds.
Lime	For adding to cement mixture for all above work	12 bags.
Cement	For concrete floor	12 pockets.
Sand	For ditto	1½ cu. yds.
Crushed stone	For ditto	3 cu. yds.
Alternative—		
Lime	For laying splash walls and walls of entrance race in 1-6 lime mortar	7 bags.
Sand	For ditto	5 cu. yds.

REINFORCED CONCRETE TANKS.

The construction of a reinforced concrete dipping tank would usually be more expensive than one of plain concrete; moreover, it is highly skilled work, and therefore hardly comes within the scope of this article. Generally speaking, this method of construction is only employed when a tank has to be built on treacherous ground.

SHEET IRON DIPPING TANK.

Dipping tanks built of thin sheet iron, which may be obtained in sections ready for erection on the farm, may in special circumstances find favour on account of their being more or less portable. Their cost does not, however, compare very favourably with one built of stone or brick under normal conditions, and their durability would be uncertain.

ALTERATIONS AND MODIFICATIONS.

Various modifications may be made to the foregoing recommendations where circumstances call for their adoption. For instance, where only small stones are available a masonry tank can be built with a concrete floor in the same way as suggested in the case of the brick tank.

Brick splash walls may be superimposed on a concrete or masonry tank.

Steel rails or pieces of old tyre iron may be set in a concrete outslope in place of the moulded concrete steps.

Expert opinions differ as to the advisability of providing steps at the end of the entrance race, and these can be omitted if desired.

Some advocate the provision of a small ridge or step about 6 inches high and 6 inches wide extending across the extreme end of the entrance race, over which the animals have to jump, this ensuring their complete immersion.

If cattle attempt to jump on the side ledges in an effort to avoid the plunge, short wooden hurdles can be placed so as to prevent this, or the ledge may be built up to a higher level for a few feet along its length, but such obstacles must not defeat the object for which the ledge is intended, i.e., to enable those in charge to control the animals in the dip.

The use of lime or dagga as a substitute for cement in building masonry or brick tanks cannot be recommended. Admittedly many tanks have been built with such materials and have proved successful for varying periods of time, but their permanence is very doubtful and such construction must be regarded as a gamble by those who, from choice or necessity, are prepared to adopt it.

Since this article first appeared several ideas have been suggested which, although not new, should increase the efficiency of the dipping tank considerably, but which are not, unfortunately, shown in the drawings.

Foot Bath.—A foot bath may be incorporated with the entrance race. It should be 8 to 10 feet long, 10 inches deep at the entrance and somewhat shallower at the exit end, where it should terminate about 6 feet from the take-off.

It should be provided with a 2 inch drain pipe at its lowest point for draining and cleaning purposes.

Mud Sump.—This consists of a rectangular sump built in concrete or bricks lined with cement, and may be about 12 inches deep, 12 inches wide and 24 inches long. It should be built as near the end of the outlet ramp as possible. A pipe or cement-lined channel must be provided to lead the fluid returning from the dripping pens into the sump, and a pipe must be set about 3 inches below the top of the sump to lead the fluid back into the dipping tank.

Both the foot bath and the mud sump will collect a lot of sludge which would otherwise find its way into the tank. They should both be cleaned out after each dipping, and it must be

remembered that the sludge from the mud sump and that removed periodically from the tank itself is highly poisonous and should immediately be buried or dumped in a strongly fenced enclosure where it can do no harm to man or beast.

Splash Ledges.—Another suggested improvement is the provision of ledges of flat stone or concrete projecting about 3 inches from the top of the tank walls and extending from the take-off for a distance of about 12 feet. Their function is to divert straight back to the tank a quantity of fluid which would otherwise spout upwards and outwards as the animals jump into the tank.

These ledges will reduce the effective top width of the tank from 5 feet to 4 feet 6 inches, and where long-horned cattle are to be dipped, it would be advisable to increase the top width of the tank by 6 inches to compensate for the overhang of the ledges.

NOTES ON CONTRACTS.

A written contract or agreement, however carefully drafted, may prove of little value in dealing with an incompetent or unscrupulous contractor, and a farmer will be well advised to employ one whose ability and integrity are well known. It is advisable even then to have some agreement setting forth the responsibilities and obligations of both parties, and the following notes may be found useful in drafting such an agreement.

It should be stated:—

(a) Who the responsible contracting parties are.

(b) The time by which the work is to be commenced and finished. When urgency is an important matter a clause may be inserted under which the contractor forfeits a definite sum for every day he exceeds the specified period, but it must be distinctly stated that such sum is by way of "liquidated and ascertained damages and not by way of penalty."

(c) The nature and amount of labour to be provided by each party.

(d) Who is responsible for any transport required for plant or materials, etc.

(e) What tools and plant are to be provided by each party.

(f) What materials are to be supplied and/or prepared by each party. The item in this clause likely to give trouble is the quantity of cement. If the contractor undertakes to supply it he may skimp the job in order to economise. On the other hand, if the employer supplies it, the contractor may demand an unreasonable quantity, and if refused, either decline to accept any responsibility for making a sound job, or, after using all the cement supplied, demand more with which to finish the job. Constant supervision is necessary in either case.

(g) Who is responsible for the care and the safety of the plant, materials and work in progress against theft and inclement weather.

(h) What drawing and specification is to be worked to. Any modification to the drawing as printed should be specifically detailed. The employer should be able to extract from this article such information as is required to specify how the work is to be performed. The specification should include a clause setting forth what test shall be accepted as indicating that the tank is water-tight.

An arbitrator, whose decision, in the event of any dispute, will be accepted as final and binding by both parties, may be named.

(i) That any alteration from the original drawing or specification required after the work has been commenced must be stated in writing, and any resultant alteration in the agreed price should be also set down.

(j) The amount and terms of payment for the work. It may be agreed that a small percentage of the original contract sum may be retained by the employer for a period of 3 or 6 months, after which it shall be paid to the contractor, provided that he has made good at his own expense any defects that may have developed or been revealed in the meantime.

Generally speaking, it is not good policy to make any payment or advance until the job is completed.

The agreement should be signed by both parties in the presence of one or more witnesses who should sign in that capacity.

No stamp is required on such an agreement.

NOTES ON THE MANAGEMENT OF DIPPING TANKS.

By J. M. Sinclair, M.R.C.V.S.

Hints on Dipping.—As proprietary dips are now generally used instead of the arsenite of soda or Natal Laboratory dip, it is only necessary to state that full instructions are supplied with each tin, and these should be rigorously adhered to.

In order successfully to accomplish the object for which the process is practised, viz., the destruction of ticks, it is essential that the fluid be maintained at the proper strength. If it falls below this, ticks are not destroyed, and so much time and money are wasted; if it becomes too strong, much injury may be caused to the animals dipped, and in some cases serious mortality may ensue.

The strength of the fluid is altered by evaporation or by addition of water. It is pure water only which evaporates, and evaporation, therefore, results in an increase of the strength of the remaining fluid. The addition of rain and flood water naturally causes a diminution in the strength of the fluid. A thatched roof is usual over the tank to prevent excessive alteration in the strength of the dip owing to evaporation or addition of rain water. If the following procedure is faithfully adhered to, the strength of the fluid will be maintained at, or

sufficiently near for practical purposes, the proper strength. After each dipping the depth of the fluid in the tank should be accurately measured, and the result recorded in a book specially kept for the purpose; it is fatal to trust to memory in a matter of this sort, where the result may be so serious. Immediately before the next dipping the depth should again be measured, and any difference in the quantity of the fluid accurately calculated. If there has been a decrease, water alone to the extent of same should be added. If there has been an increase, dip should be added in proper quantity to make such increase equal in strength to that which is being used in the tank. On no account should this procedure be omitted, even where the increase or decrease is small, because the repetition of such must result either in the fluid becoming so weak as to be useless, or so strong as to be injurious and even fatal.

Each animal that passes through the tank takes with it a quantity of the fluid, estimated at between half and one gallon; the level of the fluid in the tank is thus gradually lowered. To make up this deficiency, water with dip in the proper proportion must be added.

The chief reason for dipping is the destruction of ticks, which are transmitters of various diseases, amongst which in cattle may be mentioned African Coast Fever, Gallsickness and Redwater. It is, however, against the spread of Coast Fever infection by this agency that dipping is now so largely practised. But it has been found that the dipping of cattle has many other advantages. Apart from the disease-bearing capacities of ticks, it is evident that their presence on animals is a serious drawback, chiefly because of the large quantities of blood extracted, which should go to growth, or to improvement in condition, or to the increase of the milk supply. Not the least of the benefits of dipping is the reduction of the mortality amongst calves from white scour, liver disease, etc. Instances can be given where such mortality has been reduced from 60, 70 or even 80 per cent to nil.

Apart from Coast Fever areas, where short intervals are necessary, dipping as a general measure should be practised every seven days. Fortnightly dipping, or dipping only when ticks are seen on the animals, is of very little value. This is evident when it is considered that our most dangerous ticks, i.e., those which transmit Coast Fever, only remain on an average four days on the bovine host. In many cases animals which to the eye are apparently free from ticks will on close examination be found to harbour large numbers of the larvae and nymphal forms, especially in the ears, where some of the Coast Fever-bearing ticks are most commonly found. It should be remembered that the ticks most commonly seen are the engorging females, that the males are small, and on a beast with an average coat, not easily seen.

It is advisable to give working cattle a day's rest after immersion in the tank, but some farmers inspan them as soon as the skin is thoroughly dry. Where seven-day dipping is practised, the dipping can be carried out on the Saturday afternoon, thus giving the animal at least 1½ days to recover.

Opinions vary as to the effect of dipping on milch cows. Some assert that the quantity of milk is decreased to a large extent for 24 hours, and even longer, after dipping; others say that the

effect in this respect is not appreciable. Assuming, however, that there is a slight immediate loss, it should be remembered that there is a general increase because of the better condition of the animals as the result of regular dipping.

MANAGEMENT OF DIPPING TANKS.

In a paper entitled "Notes relating to Arsenical Dipping Fluids," by Mr. A. G. Holborow, F.I.C., Assistant Agricultural Chemist, which appeared in the "Rhodesia Agricultural Journal" of December, 1915, it is stated that "it should be an easy matter, knowing the volume of liquid in the tank and the exact strength of it, to rectify any deviation by adding water only, or dip, as the case may be, and bring the dipping fluid to any desired strength." The writer agrees entirely with this view, but his experience shows that many owners and managers of tanks find a considerable difficulty in doing so. In some cases the reason is that the capacity of the tank inch by inch is not known, or, if known, is not made use of in calculating the quantity of water or dip required to bring the liquid in the tank to the proper strength. In other cases, the quantities are calculated in a haphazard or crude manner, with the result that the strength may be so increased as to cause damage to the cattle, or so diminished as to be ineffective. The tendency in the majority of cases is in the latter direction, probably because the persons concerned, not being quite sure of their quantities, prefer to err on the side of safety.

The following notes on the management of the dipping solution and dipping tanks generally will, it is hoped, be of some assistance to stock owners.

1. At the first filling the water should be measured into the tank by a 200 gallon or other convenient measure.

2. From the 5 feet level the volume, inch by inch, should be carefully recorded and marked on the wall of the tank, or preferably on a measuring rod, which can be obtained at a small cost.

3. The level should be recorded after each dipping and again before the following one.

4. When a sample is taken for analysis the quantity of solution in the tank at the time should be accurately estimated, otherwise it is impossible to rectify any excess or diminution of strength shown by such analysis.

5. The following example is given of correcting the strength of the solution in the tank on receipt of the result of the analysis:—

(a) capacity of tank at proper dipping level—say 4,000 gallons;

(b) prescribed strength of dip used—say, 1 to 400 gallons of water;

(c) quantity of solution in tank at date sample was taken—say, 3,600 gallons;

(d) assume analysise shows strength—1 in 450;

(e) then the 3,600 gallons in tank contain 8 gallons of dip only, instead of 9 gallons; therefore, 1 gallon of dip must be added to bring the solution up to proper strength;

(f) there remain the 400 gallons of water required to bring the volume in tank up to the proper dipping level; this requires another gallon of dip;

(g) the total quantity of dip, therefore, which is required to rectify the diminished strength of the solution in the tank, and provide for the 400 gallons of additional water added to the tank, is 2 gallons.

6. Where necessary, the tank should be protected by drains, to prevent the dip being flooded out on to the surrounding veld.

7. When not in use, the entrance and exit of kraals and draining pens should be properly secured.

8. The draining pens should be so constructed that dip cannot collect in them.

9. The drums, whether closed or not, containing the concentrated dip, should be kept under lock and key.

10. When emptied, the drums should be immediately and thoroughly washed, and the washings placed in the tank or buried.

11. Where kraals are used in addition to draining pens, in order to allow cattle to drip and dry completely, cattle should not be allowed into them until any water which may have collected in pools has been dispersed.

12. Tanks should be so protected by fencing that animals cannot have access to any ground contaminated with arsenic from splashings during dipping and leaking draining pens.

ARSENITE CATTLE DIP.

How to Mix.

First dissolve the arsenite in a sufficient quantity of hot water to dissolve the crystals completely. Then add water to make up to 400 gallons, stirring vigorously the while.

Although it will probably be found most convenient to dissolve the arsenite in a few gallons of hot water, this may be carried out in a short time with cold water in the following manner:—

Place two or three pounds of arsenite in a bucketful of water and stir vigorously for five or ten minutes. Allow any undissolved particles to settle, and pour off the liquid into a tank. Then add more arsenite to that remaining in the bucket and fill up with water again, repeating this till all the arsenite is dissolved.

Have proper weights and scales, and be accurate in measuring the arsenite. Always keep arsenite under lock and key as a dangerous poison. All arsenite must be completely dissolved before being added to the dipping tank.

Solutions prepared as above can be added to tanks now containing arsenical proprietary dips.

For three-day dipping:—

4 lbs. arsenite of soda (80 per cent. arsenious oxide) to every 400 gallons of water.

For seven-day dipping:—

8 lbs. arsenite of soda (80 per cent. arsenious oxide) to every 400 gallons of water.

WASTAGE OF DIP IN DIPPING OPERATIONS.

Owing to the high cost of cattle dip, the conservation of fluid by the use of adequate draining pens is a matter of pounds, shillings and pence, and, as it will probably be a long time before prices come down to pre-war rates, tank owners would be well advised to consider the draining arrangements at their tanks with a view to reducing wastage to a minimum.

The following observations made by the Department show that proper draining accommodation means a saving of many pounds per annum:—

Tank.	Drainage.	No. of Cattle.	Wastage in Gallons.
1	Large single pen.. ..	1,250	480
2	Double pen	680	200
3	Race 34 feet	603	300
4	Race 30 feet	1,004	720
5	Race 60 feet	1,200	400
6	Race 60 feet	1,643	385
7	Race 72 feet .	1,650	290
8	Race 72 feet	1,635	300

In considering these quantities, the size of the cattle must be taken into consideration. At tanks Nos. 1, 3 and 4, which are on or adjoining Salisbury Commonage, dairy cattle predominate, and the number of small animals—i.e., calves, yearlings and two-year-olds—will therefore be greater than in the average herd of farm cattle. The cattle at No. 2 tank are highly graded throughout, and the average size is considerably larger than in average herd of farm cattle. At tanks Nos. 5 to 8 inclusive the animals are of the small Mashona type. The double draining pen and the long draining races are very economical; in the latter the wastage is governed largely by the speed at which the cattle are driven through it. The single draining pen can be made as economical as any other plan, but only by a considerable wastage of time.

DIRECTIONS FOR TAKING SAMPLES OF DIP.

The taking of a sample of dip requires care, and should never be left to a native. Thoroughly cleanse a bottle of the "whisky" size. When the contents of the tank have been thoroughly stirred, preferably by the actual dipping of cattle, rinse out the bottle with solution from the tank. Then fill the bottle completely with solution, cork securely, and stick on the bottle a label stating sender's name, farm, postal address, kind of dip used and the date on which the sample was taken.

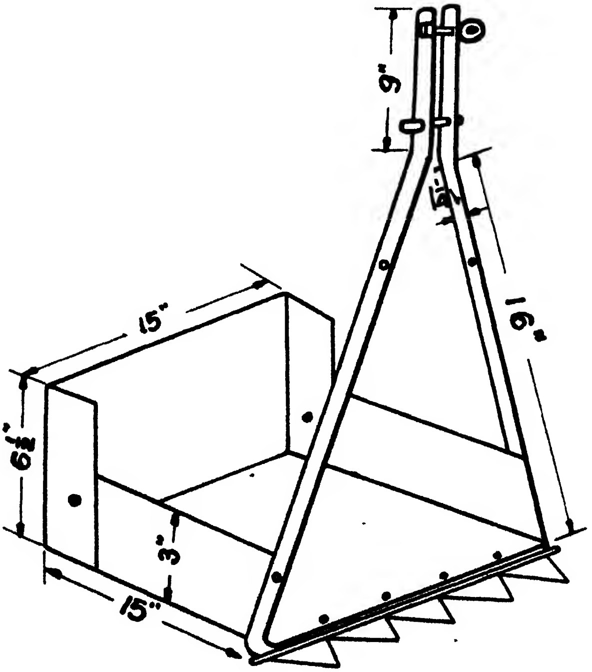
When it is expected that the sample will take a week or more to reach the laboratory, it is wise to add about ten spots of sulphuric acid (free from arsenic) to prevent oxidation en route.

A farmer should not expect the chemist's analysis to save him the trouble of keeping account of the amount of water and dip added to or lost from his tank.

A DIP-TANK DREDGER.

Dipping tanks in use always tend to accumulate a quantity of sediment at the bottom. Though this cannot be avoided, the deposit should be cleaned out as often as possible, because not only is it objectionable to use a filthy dipping fluid, but if the slime or mud is left undisturbed week after week it soon increases sufficiently to reduce appreciably the capacity of the tank. The result is that measurements of the quantity of solution present, based on fixed marks on the tank wall, cease to be accurate, and any estimate of the amount of chemical dip or water to be added will be unreliable, so that it becomes impossible to keep the solution at the right strength. The danger of this state of affairs is obvious, and the only remedy is to clean out the tank regularly.

In order that this may be done without emptying the receptacle, several devices have been tried with varying success. One of the best which is in use in the Salisbury district is shown in the diagram (fig. 3), which gives the approximate dimensions. Little further description is necessary beyond stating that the material of the scoop is thin sheet iron riveted as shown, the front edge is armed with part of an old mower blade riveted in place, the two bent stays are made of flat iron, and the two bolts shown



CATTLE TANK DREDGER
Fig 3.

near the top are for holding in position a vertical pole about ten feet long. On the oblique part of the stays will be seen two small holes drilled in the flat iron. These are for the reception of two lengths of strong wire.

The method of use is as follows: The scoop is dropped to the bottom near the middle of the tank, being kept in place by the upright pole held by a man standing on the top of the wall. At the plunge end, two persons hold the ends of the long wires ready to pull. As soon as a strain is put on the wire, the pole-holder may, if necessary, give the scoop a slight forward tilt to cause the mower teeth to enter the mud. When the scoop is full, it is lifted out at the plunge end by means of the two wires and the pole, the latter being now slightly tilted backwards. The process is repeated as often as possible, working always towards the plunge end of the tank, where the greatest mass of deposit will be found. It would be an advantage if the tank were dredged after every dipping day, especially where large numbers of cattle are put through, but this is not absolutely necessary, and in practice it is only used occasionally as the sediment collects.

SLEEPING AND WAKING.

Wake up to the fact that, even while you sleep, benefits accrue in the wake of agricultural cleanliness. Sleep over it!

Cleanliness Aids Insect Control.

Report on the use of a 4-unit Gascoigne Milking Machine

AT THE GOVERNMENT EXPERIMENT STATION, RHODES MATOPO ESTATE.

By C. A. Murray, M.Sc. Ag., Senior Animal Husbandry Officer in Charge, Rhodes Matopo Estate.

For the purpose of obtaining information on the use of milking machines under local conditions, the Dairy Control Board purchased and loaned to the Government Experiment Station, Matopos, a 4-unit Gascoigne milking machine. The plant was properly installed by the South African Agency representative.

It was used during an approximately two-year period on our herd of grade and pure bred Red Poll cows. The number of cows milked by machine varied from 32 to 45—average 42.

In the running and use of the plant the makers' instructions were carried out as carefully as was possible.

Below are given briefly the results obtained.

Mechanical Efficiency and Cost of Operation.—The plant was run under the general supervision of the Stockman, who had had previous experience in Scotland with similar type machines. When first put into use none of our native milkers had ever before seen or worked with a milking machine. They were, however, carefully shown and after a fortnight were au fait with its handling.

Generally speaking the mechanical operation of the machine is very simple and it can be run by an intelligent native under European supervision. As a matter of fact, during the major port of the trial, the plant was run by our head stable boy under the Stockman's general supervision.

On the average, one native could not handle more than one unit efficiently, and it was only after several months' experience that the best stable boy could handle two units efficiently, and this only when the rubber tubing and, especially, the teat cup liners were in first-class condition. It was found that the teat cup liners started weakening after about five months' use and, unless replaced, gave considerable trouble at milking by continually falling off the teats. It appeared that these required replacement every six months and the other rubber parts annually.

No major mechanical difficulties were experienced with the machine. The 2 h p. Lister paraffin engine which ran the vacuum pump gave no trouble, except that it had to be de-carbonised after 16 months' use. The vacuum pump, sanitary trap, vacuum controller and vacuum gauge worked well throughout. The only parts that gave trouble after 15 months' use were the pulsators, and on several occasions these had to be attended to.

The cows took very readily to being milked by machine, and from the fourth day on no difficulty at all was experienced. During the whole period only one cow out of close on 100 different ones that passed through the stables could not be persuaded to be machine milked.

To find out whether the milking machine in any way upset the cows, a group of 6 cows was taken and alternately hand milked and machine milked for 14 day periods.

Below are given the average production figures for the 14 day periods.

Hand Milked.		Machine Milked.	
Period.	Total lbs. of milk.	Period.	Total lbs. of milk.
14/7/40-27/7/40	1.497	28/7/40-10/8/40	1.511
11/8/40-24/8/40	1,499	25/8/40- 7/9/40	1,480
8/9/40-21/9/40	1,432	22/9/40- 5/10/40... ...	1,389

Although there appears to have been a steady decline in the total daily and total fortnightly milk yields of the group as the trial proceeded, it was due to the more advanced stage reached in the lactations of the cows and not to the method of milking. A close examination of the total fortnightly yields given above and Figure I. seems to show very clearly that the use of the machine brought about no higher production and that the change over from machine to hand milking and vice versa affected the cows in no way.

Operating costs of the machine were rather high. It must be pointed out, however, that it is difficult to give figures for these costs which will apply generally. For example, the type of power used (electricity, paraffin or crude oil) show wide variations in initial running costs and so on. However, the particulars given below will give a rough indication. The charges are made up of:—

(1) **Fuel Costs.**—The fuel consumption of the 2 h.p. Lister engine which ran the vacuum pump was .43 gallons of paraffin and/or petrol per day. It was run altogether for just on an hour in the morning and an hour in the evening, i.e., about 2 hours daily. The oil consumption during the whole period was low and, for the purpose of making a charge, negligible.

(2) **Replacements.**—These consisted mainly of rubber parts, of which the machine had a very generous number. As pointed out above, teat cup liners required replacement every six months and other parts annually. Although we replaced rubber parts only when absolutely essential, the annual cost was about £6 7s. 6d., or approximately 10s. 6d. per month. No expenditure was incurred during the two years period on any other parts of the plant except that, as pointed out previously, the pulsators had to be attended to on several occasions. The normal life of these is unfortunately not known, but I should not think more than 3 to 5 years.

(3) **Cleaning Costs.**—These amounted to about 6d. per day. It was found that one half a pound of either Super Kinray or Wyandotte Cherokee morning and evening were the minimum quantities of these cleansers that could be used for efficient cleaning of the different parts.

(4) **Depreciation.**—It is difficult to estimate with any degree of accuracy the life of a plant of this kind. I doubt, however, if it could be put at more than 10 years. As the original cost of the plant was £180, depreciation at 10 per cent. will amount to £18 per annum, or £1 10s. per month.

The total annual operating costs of the machine were, therefore, more or less as follows:—

	£	s.	d.
Power—157 gallons paraffin and/or petrol @ say 2s. per gallon ...	£15	14	0
Replacements—Rubber parts ...	6	7	6
Cleanser—365 lbs. @ 6d. per lb. ...	9	2	6
Depreciation 10 per cent. ...	18	0	0
Total ...	£49	4	0

or £4 2s. per month.

It should again be emphasised, however, that these figures must necessarily be approximate, but it is believed that they give a fairly good indication of average operating costs.

Efficiency and Rate of Milking.—The makers recommend leaving the machine on the cows for four minutes only. It is stated that this is the optimum period and that, at the end of it, all the milk except the strippings will have been drawn off.

To get some information on this point two similar groups of six cows were used. The individual and average production of the two groups were very nearly the same—about 20 lbs. per cow per day.

With Group I. the machine was left on for exactly four minutes and with Group II. until no more milk passed through the milk tubes. The milk was then weighed, the cows stripped and the strippings weighed.

The results obtained are given briefly below in Table I.:—

TABLE I.

GROUP I.—Machine left on for exactly 4 minutes.

Days.	Morning Milking. lbs. Milk.	Morning Milking. lbs. Strippings.	Morning Milking. Total.	Evening Milking. lbs. Milk.	Evening Milking. lbs. Strippings.	Evening Milking. Total.
1st	11.2	1.5	12.7	7.5	1.3	8.8
2nd	10.7	1.2	11.9	6.6	1.2	7.8
3rd	11.6	1.5	13.1	6.9	1.1	8.0
4th	12.4	1.4	13.8	7.4	0.9	8.3
5th	11.3	1.6	12.9	7.5	1.2	8.7
6th	12.1	1.5	13.6	7.1	1.2	8.3
Total ...	69.3	8.7	78.0	43.0	6.9	49.9
Av. per cow per day .	11.6	1.5	13.1	7.1	1.2	8.3
Milk drawn by machine			89%			87%
Strippings left			11%			13%

GROUP II.—Machine left on until no more milk passed through tubes.

	a.m. Milking. Time taken.	lbs. Milk.	lbs. Strippings.	Total.	p.m. Milking. Time taken.	lbs. Milk.	lbs. Strippings.	Total.
	m. s.				m. s.			
	5 12	12.9	0.8	13.7	4 14	8.8	0.7	9.5
	5 8	12.9	0.7	13.6	4 36	8.7	0.7	9.4
	5 20	12.8	0.8	13.6	4 15	8.6	0.9	9.5
	5 7	12.3	0.9	13.2	4 42	9.1	0.8	9.9
	5 16	12.0	1.0	13.0	4 22	8.6	0.9	9.5
	5 21	12.9	0.7	13.6	4 31	9.1	0,7	9.8
Ttl.	31 24	75.8	4.9	80.7	26 40	52.9	4.7	57.6
Av. per cow per day	5 14	12.6	0.8	13.4	4 26	8.8	0.8	9.6
Milk drawn by machine				94%				92%
Strippings left				6%				8%

From Group I. it will be noticed that when the machine was left on for exactly four minutes the morning and evening strippings amounted to 11% and 13% respectively of the total milk produced at these two times. In other words, in the morning with the larger quantity of milk produced the machine drew off about 89% of the milk and in the evening with the smaller amount of milk produced, about 87% in four minutes.

The cows used in this trial all gave from 19 to 22 lbs. of milk daily. In order to determine whether the same result would be obtained from higher producing cows, four cows were used giving on the average between 3½ and 4 gallons of milk daily.

Over a ten day period the average results were as follows:—

Machine left on for 4 minutes.

	a.m. Milk ex machine.	Strippings.	Total.	p.m. Milk ex machine.	Strippings.	Total.
	22.1	2.2	24.3	13.2	1.6	14.8
Milk drawn by machine			91%			88%
Strippings left			9%			12%

Although the actual amount of milk left (Strippings) was slightly higher with the 3½-4 gallon cows than with the 2 gallon ones, the percentage was less and hence the efficiency of the machine slightly higher. With these cows the machine took off in four minutes 91% and 88% of the total milk in the mornings and evenings respectively.

From Group II. in Table I. above it will be noticed that it took on the average 5 minutes 14 seconds in the mornings and 4 minutes 26 seconds in the evenings for the machine to take off all the milk it could. During these longer periods it took off only an additional 0.7 lbs. and 0.4 lbs. respectively, which was so little that it could be removed much quicker by hand.

With the 3½-4 gallon cows the following figures were obtained:—

Machine left on until no more milk passed through the tubes.

a.m.				p.m.			
Average time machine left on.	lbs. milk ex machine.	Strippings.	Total.	Average time machine left on.	lbs. milk ex machine.	Strippings.	Total.
m. s.				m. s.			
5 31	23.3	1.6	24.9	5 2	13.6	1.2	14.8
Milk drawn by machine			94%				92%
Strippings left			6%				8%

These results are much the same as those obtained with the lower yielding cows and so, with even up to 4-gallon cows, there seems to be no point in leaving the machine on for more than four minutes.

The question was raised as to whether stripping is advisable or not.

Firstly, the amount left by the machine varies from 6% to 13%. This means that with a herd producing, say, 100 gallons of milk per day the farmer will lose from 6 to 13 gallons daily if he does not strip. This is a heavy loss, especially since no extra labour is required to remove it.

In regard to the butterfat content of milk from an unstripped cow average data from 10 cows are given below:—

	Milk ex machine. lb.	Milk ex machine. %B.fat.	Strippings. lb.	Strippings. %B.fat.	Milk ex machine plus Strippings. lb.	Milk ex machine plus Strippings. %B.fat.
Total for 6 milkings... ...	54.8	3.25	5.3	6.00	60.1	3.60
Average for each milking	9.13	3.25	.88	6.0	10.01	3.60

Average weight of butterfat produced daily .73 lb., of which 14.6 per cent., or nearly one-seventh, was contained in the strippings.

These figures emphasise the necessity for stripping. Unless the cows are properly stripped a considerable portion of the butterfat may be left in the udder. In the case of low testing cows this may mean that the milk may fall appreciably below the legal standard for butterfat, which in this Colony is a minimum of 3 per cent.

Rate of Milking.—As the machine draws off in four minutes from 87 to 91 per cent. of the total milk yield of a cow at any milking irrespective of the amount of milk she gives* the actual rate of milking, i.e., the amount of milk taken off per minute will vary according to the production of the cow. It is obvious,

*The highest producing cow used in our tests gave 40 lbs. daily, i.e., approx. 25 lbs. a.m. and 15 lbs. p.m.

therefore, that the machine will milk any cow of the capacity we used in four minutes plus the time required to put the machine on and to remove it and remove the strippings by hand. These additional operations took, on the average, just one minute, which means that the average time to machine milk a cow is 5 minutes.

To see how this compared with hand milking six different milkers, milking at different times a total of 10 cows averaging just on two gallons daily, were timed for a five day period, and the following results obtained:—

a.m. Average milk.	Time taken.	p.m. Average milk.	Time taken.
11.4	5 mins. 40 secs.	7.7.	5 mins. 1 sec.
Av. amount per minute—2 lbs.		Av. amount per min.—1.5 lbs.	

It will be seen that the average rate of hand milking was 2 lbs. per minute in the mornings and 1.5 lbs. in the afternoons. It must be pointed out, however, that unlike with the milking by machine there is very considerable variation in the time taken to hand milk cows. This variation is due not only to differences in production but also to factors such as the toughness or otherwise of the cows as milkers and the ability of those milking. We found some milkers could, with certain cows, milk at the rate of nearly 4 lbs. per minute, whereas others milked certain cows at the rate of just over 1 lb. per minute.

The only reason that can be given for the lower rate of milking in the afternoons, and this was consistent, is that the milkers were somewhat tired after nearly a day's work.

CLEANING OF THE MACHINE AND ITS EFFICIENCY FOR THE PRODUCTION OF CLEAN MILK.

By J. R. Corry, B.Sc. Ag., Chief Dairy Officer.

In order to obtain some information as to the efficiency of the machine for the production of milk of low bacterial content the following experiment was undertaken:—

DETAILS OF THE EXPERIMENT.

1. Half the cows were milked by hand and half were milked by machine. Duplicate samples were taken at fortnightly intervals of the morning's milk from the machine and hand milked groups; one sample from each group being immediately taken to the Public Health Laboratory, Bulawayo, for examination for bacterial content, the other samples were held at temperatures varying from 60-70 for a period of 10-12 hours from the time of production, and were then placed in a refrigerator and held at a temperature of 35-36 F. until the following morning when they were subjected to the modified Methylene Blue Reductase test. The results are shown in Table II.

TABLE II.

Date samples taken.	Bacterial Plate Count No. of Bacteria per c.c. of milk.		Methylene Blue Reductase Test. (Time in hours).	
	Machine milk.	Hand milk.	Machine milk.	Hand milk.
3. 7.39	3,510	3,450	7½	5
5. 7.39	6,800	3,650	10	14
8. 8.39	5,425	4,980	8	8
23. 8.39	8.300	5,500	6	8
5.10.39	966,000	4,350	1	8½
27.10.39	133,150	4.450	1½	6
9.11.39	412,000	6.500	1	2½
29.11.39	378,500	14.450	2	4½
8.12.39	Unaccountable		1	2½
31.12.39	1,760	1,640	6+	6+
7. 5.40	9,000	2,150	5½	5
24. 5.40	2,500	5,500	24*	8
8. 6.40	8,700	4,400	8	7½
24. 6.40	—	—	8	8

*The reason why this sample took such a long time to decolourise the Methylene Blue is not known.

2. For the first few months, i.e., for the period covered by the first four tests shown in Table II., the milking machine was cleaned after every milking in accordance with the makers' instructions:—

1. External dirt adhering to the teat cups and tubes was removed and the unit was then connected up with the vacuum line and cold water drawn through the teat cups, into the milk pail, the teat cups meanwhile being moved in and out of the water to obtain the necessary "surging" action emphasised by the makers.

2. After washing with cold water the operation was repeated, using boiling water containing "Super Kinray" dairy cleanser; the washing was finally completed by drawing cold water through each unit to remove all traces of cleanser, the teat cup cluster then being hung up to drain.

3. Twice a week the units were taken apart and all the teat cup liners, claw piece, milk and air tubes, etc., were thoroughly brushed and cleaned in a hot solution of Super Kinray, thereafter being rinsed in clean hot water.

4. The milking buckets and all other utensils after being cleaned, were placed in a steaming chest and steamed at a temperature of about 200 F. for about 30 minutes.

After the experiment had been in progress about three months the bacterial counts increased enormously until in the case of on sample, i.e., on the 8.12.39, the organisms present were so numerous as to be uncountable. See Table II. On investigation it was found that the operators had departed from the makers' instructions regarding cleaning and that the rubber parts were showing signs of wear.

A thorough cleaning and sterilisation by steam of all rubber parts of the machine and all buckets and utensils produced the results shown opposite the date 31.12.39, when the plate count dropped to less than 2,000 bacteria per c.c.

A comparison of the plate counts taken on the 8.12.39 and 31.12.39 illustrates very forcibly the necessity for the proper cleaning and sterilisation of the machine. Thereafter new rubber parts were obtained and these, in addition to being cleaned in accordance with the makers' instructions, were sterilised by steam; to do this the teat cup liners were removed from the teat cups and placed, together with the milk tubes, in a muslin bag which was suspended in the steaming chest.

As long as this procedure was followed no difficulty was experienced in producing milk of low bacterial content or which would conform to the legal standard for the Methylene Blue Reduction Test which, in this Colony, requires that milk shall not decolourise Methylene Blue within four hours in the case of samples taken from 1st October to 31st March, or within five hours for samples taken between 1st April and 30th September.

It would seem that as long as the teat cup liners and milk tubes are new and in good condition, milk of quite satisfactory quality—certainly as good as that obtained by hand milking—can be produced by adhering to the makers' instructions for cleaning. For consistently good results, however, daily stripping and cleaning and sterilisation by steam of teat cup liners, milk tubes, etc., is necessary. This is particularly necessary in the case of old or worn rubber parts.

This procedure, however, seems to shorten the life of the rubber parts, which do not appear to stand up very well to daily steaming. It was made abundantly clear in this experiment also that to produce consistently good results the cleaning and sterilisation of the machine must be carried out under European supervision.

SUMMARY.

The Dairy Industry Control Board loaned a 4-unit Gascoigne milking machine to the Government Experiment Station, Matopos, where it was tested out for an approximately two-year period.

The mechanical operation of the machine was very simple and could be attended to by an intelligent native under European supervision.

Cows easily took to being milked by the machine and its use had no increasing or decreasing effect on their milk production.

For cows giving from 15 to 40 lbs. of milk daily it was found unnecessary to leave the machine on for more than 4 minutes at a milking. During this period it removed from 87% to 91% of their total milk yield.

The necessity for stripping cows after they had been milked by machine was clearly shown. The strippings not only represented 9 to 13% of the total milk production of the cows but contained nearly 15% of the total butterfat produced.

For cows of the capacity used in the trials, machine milking showed hardly any saving in time as compared with hand milking. Under the conditions of this trial the milking machine did not prove a labour-saving device.

It was found that milking by machine could produce milk of as low bacterial content as milking by hand, provided:—(a) the rubber parts, especially the teat cup liners and milking tubes, were replaced immediately they showed signs of wearing, and (b) the cleaning was carried out according to the makers' instructions and the equipment and rubber parts sterilised daily.

To obtain consistently good results, it was found absolutely necessary that the cleaning and sterilisation be carried out under European supervision.

Operating costs of the machine were rather high—£4 2s. per month. Power (paraffin in this case) replacements, cleaning powder and depreciation accounted for 32%, 13%, 18% and 37% respectively of these costs.

ACKNOWLEDGMENTS.

Grateful acknowledgment and thanks are due to the Dairy Industry Control Board for generously providing the machine without which the tests could, naturally, not have been carried out, and to the Public Health Laboratory, Bulawayo, for reporting on the bacterial content of the milk samples.

The Potato.

(Solanum tuberosum.)

METHODS OF CULTIVATION IN SOUTHERN RHODESIA.

By S. D. TIMSON, M.C., Assistant Agriculturist.

[*This article was first published in* 1931 *and reprinted as Departmental Bulletin No.* 836. *Stocks of the latter are exhausted, and the article is therefore re-published after revision and condensing.*]

Uses and Composition.—The potato varies very considerably in composition according to the variety, the soil and climate in which it is grown, and the degree of maturity and conditions under which it is stored.

The following analysis* is the average of 465 analyses and gives the average percentage composition of the potato tuber.

Water.	Starch.	Protein.	Ash.	Fat.	Fibre.
78.8	17.4	2.2	1.1	0.1	0.4

A large proportion of the protein and ash constituents or minerals is contained in the outer layers of the tuber and much of this is lost in peeling for cooking. Therefore the potato loses least of its food value if boiled or baked in its skin.

The ash contains a high percentage of potash and phosphoric oxide, the former constituting 60.4 per cent. and the latter 17.3 per cent., according to an average of 53 analyses by Wolff quoted by Blyth in his "Foods." This gives some indication of the great need the potato plant has for an ample supply of available potash and phosphate in the soil.

The potato is a useful stock feed and the "culls," which are of no value for sale or seed, may well be fed to cattle, horses or pigs. According to Henry and Morrison ("Feeds and Feeding") up to 30 lbs. per day of cooked potatoes may be fed to milk cows and somewhat less if fed raw. As much as 17 lbs. per day may be fed raw or cooked to horses and small quantities may be fed each day to pigs, but in this case the tubers should be cooked and fed mixed with grain. In France, Girarde fed 55 to 66 lbs. of cooked potatoes per day to fattening steers and 4½ to 6½ lbs. to fattening sheep.

Since potatoes are deficient in protein and ash, they are not a suitable feed for young, growing stock. Animals should not be watered soon after feeding on potatoes, but preferably half an hour before feeding.

*"Feeds and Feeding," by Henry and Morrison.

Potatoes are also useful to the poultry keeper and can be fed in large quantities to fattening birds, ducks, geese and turkeys. For this purpose they should be cooked and fed in the mash. They are unsuitable for laying hens or for young growing birds.

Flour, glucose for jam-making, syrup and mucilage, besides a number of tinctures, are also made from the potato.

Soil and Climate.—The ideal type of soil for potato culture is a deep, free-working, fertile loam, which is well drained and above all, possesses an ample supply of decayed organic matter or humus.

A free-working, friable soil is essential for the best results for the following reasons. The root system of the plant is weak and fibrous, having no strong tap-root or side roots which can penetrate a stiff, heavy soil. Since the growing season of the crop in this Colony is so much shortened by the attack of Early Blight disease, as compared with the long growing season assured in England, it is essential that the potato crop should be able to obtain its food supply quickly and easily. This is in part assured by providing it with a light open soil and by affording ample and quickly available supplies of plant food.

An open porous soil is also necessary to enable the tubers to develop freely. In heavy soils, especially when periods of drought, during the time the tubers are growing, are experienced, they make very irregular growth, and their skin becomes roughened.

In heavy soils, or in those which harden on drying out in autumn, the crop is difficult to lift, the tubers may be damaged during the operation and many may be left in the ground. Stiff, heavy soils are also very difficult to work and often retard planting operations. In a light open soil provided with an ample supply of organic matter, fertilisers and manures applied to the crop are more readily available, and so will be more effective. Nevertheless, the potato crop can be grown with success on practically all types of soil which are fertile, have a sufficient supply of humus, and are well drained. Even the comparatively heavy loams of the maize belt will grow heavy crops of good quality, provided that a sufficient supply of organic matter is made available by heavy dressings of compost or kraal or farm-yard manure, and/or by green manuring. Potatoes grow particularly well on virgin soil provided it has a sufficient supply of humus, and has been very thoroughly worked to a fine tilth. It is a good practice to green manure virgin soil before planting potatoes, as this mellows the soil and increases the supply of humus and available plant food.

Where potatoes are grown on land which is under irrigation year after year, great difficulty is usually experienced, particularly on the red and chocolate soils of this Colony, in obtaining a satisfactory tilth, owing, no doubt, to the exhaustion of the humus supply. This condition of affairs may readily be remedied by growing a green manure crop, such as sunnhemp, on the land during the summer and ploughing it under in February or March. By thus maintaining the humus supply in the soil, it will be a simple matter to obtain a mellow tilth. It will also help to

maintain the natural fertility of the soil and make it possible to reduce somewhat the quantity of fertilisers which must be applied, and at the same time will assist the crop to make full use of those which are applied. Dressings of compost or kraal manure should be used in addition to green-manuring.

Varieties.—Practically only one variety of potatoes is grown in Southern Rhodesia at the present day, namely, the Up-to-date. Each year considerable quantities of Scotch Up-to-date "seed" are imported and the first and second crops from this are used for the further plantings.

Many other varieties have been tried in the past and have been discarded for various reasons, although some, such as Majestic, have proved to be high yielders. Some have failed to hold their place owing to inferior keeping qualities, and others owing to low grade of the tubers.

Manures and Fertilisers.—It is essential for the profitable production of the main or summer potato crop that the soil shall be in high condition both as regards fertility and tilth, since the growing season is only 4 to 4½ months long as compared with a growing season of 7 months in Great Britain. This short season is largely due to the attacks of "Early Blight" (*Alternaria solani*), which kills off the haulms of the plants some time before the crop has reached normal maturity and just at the stage of growth when the tubers are swelling, and most in need of the supply of food material manufactured by the foliage. These facts must always be borne in mind when considering the question of the manuring of the crop, since it makes it particularly necessary to force its growth as far as possible, at the same time giving due care to the danger of inducing an excessive top growth at the expense of tuber production.

With the winter crop there is the same need for forcing the growth and hastening maturity, since the best prices are obtained for the new potatoes which are first on the market after the main crop supply is more or less exhausted.

Need of Organic Matter.—An ample supply of organic matter in the soil is the first essential to success in growing potatoes, since this assures a fine open tilth to the soil, and without it the crop cannot make proper use of the fertilisers which are applied to force its growth and supply the large needs of the plants for readily available food. This is best assured by the application of compost or farmyard manure. If high acre yields of potatoes are aimed at, and this normally helps to assure a low cost of production, it is essential to apply heavy dressings of compost or farm manure, and a dressing of 15 to 18 tons per acre is not excessive.

Where such heavy dressings are applied, they may be broadcasted and covered by the first ploughing. With light dressings it will probably be best to spread the manure in the furrows before planting.

The compost or kraal manure must be in a thoroughly rotted condition so as to ensure availability of plant food, as far as possible, and to reduce subsequent trouble with excessive weed growth.

One of the most important functions of such heavy dressings of organic manure is to render the soil as friable as possible, so that a very fine open tilth may be maintained which will facilitate the working of the soil; render easy the penetration of the soil by the weak root system of the plant; and ensure that no check is placed on the development of the young growing tubers. The easy lifting of the crop with a minimum of loss is also assured, and the moist cool condition of the soil required by the potato plant for its best and most rapid development. Well made compost has been found to be considerably more effective than kraal manure in lightening heavy soils, and it is, of course, practically free from viable weed seeds.

Farm experience over the past six years also indicates (as is to be expected) that the plant foods in compost, particularly the nitrogen, are more available to the crop than those in kraal manure.

Fertilisers.—If dressings of good quality, well-rotted compost, of 15 tons per acre or more, have been ploughed into the soil, this should normally supply the nitrogen and potash requirements of the crop, but additional phosphate will be required. A dressing of 500 to 600 lbs. per acre of 20 per cent. superphosphate will be suitable. This may be spread down the furrows, and mixed with the soil by dragging the branch of a tree along each furrow, so as to ensure that the tubers are not in direct contact with the fertilisers, since this will damage them.

In making a batch of compost for application to the potato crop, it is advisable to use considerably more wood ashes in order to raise the potash content of the ripe compost. The wood ashes should not have been leached by the rain, since this causes the loss of most of the soluble potash. Ample supplies of potash are very necessary for the potato crop, and where the soil is known to be deficient in available potash it would be advisable to apply a complete fertiliser containing about 8 per cent. of potash instead of the superphosphate dressing advised above.

Where kraal manure must be used instead of compost it will also be advisable to apply the complete fertiliser instead of superphosphate alone, since the plant foods in the manure are less available to the crop than those in well made compost. A suitable dressing would be 500 lbs. to 800 lbs. per acre, varying with the fertility of the soil.

Where only moderate dressings of compost or manure can be applied to the crop it will also be advisable to use a complete fertiliser, and the supply of organic matter can be reinforced by the ploughing in of a green manure crop such as sunnhemp, which is immune to eelworm. It must be emphasised that sunflowers, dolichos beans and most cowpeas and soya beans are very susceptible to eelworm, and should never be grown on land which is to be used for the potato crop in the future.

The above brief notes on the subject can only serve to indicate the lines on which the manurial needs of the crop are to be met, and farmers are advised to consult the Department of Agriculture with regard to their own particular case, if they have little or no experience in the growing of the crop.

in a wet condition, the best time of planting is from mid-November to mid-December. On the heavier red and chocolate clay loams the danger of packing the soil is so great that it may be necessary to plant in October or early November before the advent of rains. Imported "seed" often does not arrive in time to allow planting before January, but this is usually too late to obtain the best yields. However, as this crop is generally only raised for "seed" the question of high yield is not of such great importance.

Depth of Planting.—It is important when planting is done in the early spring in dry soil before the arrival of the rains, that the tubers should be buried deeply, so that they and the soil surrounding them do not become unduly heated by the sun. If this is not done there is great danger, after light showers, of the tubers being destroyed by a form of rot, which is described in Departmental Bulletin No. 825.

The tubers should be planted so that, after the splitting back and pulling down of the ridges, there is at least 4 to 5 inches of soil above their upper surface.

Where planting is done in moist soil and more rain is likely to follow, the depth of planting may be less.

Planting under Irrigation.—Various modified methods of planting and covering the "seed" are practised where the crop is irrigated, and the reader may have his own method, but the following are those normally employed with success. (1) The tubers, after placing them in the bottoms of the furrows, are covered with soil to a depth of about two inches by pulling down the soil into the furrows with hoes, and the water may then be led down the furrow directly over the potatoes. As soon as the plants have made sufficient growth to enable them to be earthed up, the original ridges are fully split back and the water is then led along the flanks of the ridges in which the plants are now growing. Where eelworms infest the soil it is well not to use this method and the second method may be employed.

(2) The tubers are planted on the lower side of the furrow, holes being made to receive them about 3 inches up from the bottom of the furrow. They are covered with about 2 inches of soil and the water is then led along the furrows. When the crop is cultivated, the soil is gradually brought down from the top side of the furrow to the lower side, about a third at a time, covering the tubers deeper each time until the original ridges are completely split and the plants come in the middle of the new ridges thus made.

This method is particularly to be recommended where the soil is known to be infested with eelworms, since it assures the tubers being kept out of the wet bottoms of the furrows, where they are most liable to damage by this pest.

(3) A third method which is used, particularly on the more hilly land, is to plant the tubers in shallow holes made with a hoe in the bottom of the furrow. They are then covered and the water led down the furrow and over the tubers until ridging renders this no longer possible, when the water is led along the flanks of the new ridges.

(4) Where the irrigated crop must be planted on a sticky heavy soil the practice followed by Mr. E. B. Etheridge, of Hartley, for many years, can be strongly recommended.

After ridging the land and applying the fertiliser in the furrows, sunnhemp straw from the seed crop is placed in the bottom of the furrows to a depth (when trampled down) of 2 or 3 inches. The tubers are then planted on top of the straw and covered by splitting back the ridges.

This practice makes the lifting of the crop from his sticky red clay loam much easier; the tubers come out comparatively clean; and above all the potatoes are of good normal shape instead of being distorted and "knobbly."

If kraal manure instead of compost is used with this method of planting it is advisable to use dressings of complete fertiliser, of at least 500 to 600 lbs. per acre, in order to ensure that the slow decay of the straw in the soil does not cause temporary nitrogen starvation of the crop.

Date of Planting the Winter Crop.—The irrigated winter crop may be planted as early as the end of January. It then commences growth with the last rains of the wet season, and after the latter cease the crop is irrigated. Excellent prices may sometimes be obtained for crops planted as early as this, but the yield is usually light. In frost-free land the crop may be planted at any time from the cessation of the summer rains up to the end of August or the beginning of September, but September planted crops seldom yield well owing to the attacks of "Early Blight" and the great heat in October and November when the plants are still young.

In situations where frosts are liable to be severe it is not advisable to commence planting until early August, though many growers gamble successfully on the absence of severe frost and plant somewhat earlier. Earlier plantings may be partially protected from frost by covering the ground after planting with grass. This layer of grass will help to protect the young plants from moderate, but not from severe frosts.

Transplanting.—It is not generally known that the transplanting of potatoes, even after they have made strong growth, can be carried out quite successfully. On occasions this may be useful, as for instance, when the stand of the new crop is poor and a volunteer crop has grown up from tubers left in the ground from the preceding year's crop. The latter may then be utilised to fill the blank places left by failures in the current year's crop. Such transplanting must, of course, be done into wet soil and care must be taken that the roots and rhizomes are not injured and that the soil is well firmed down round the roots after transplanting.

" Seed Potatoes."—The question of his " seed " supply is the most important one which faces the grower of potatoes, and one on which the whole success of his enterprise depends. The problem of securing the supply of seed best suited to each grower's particular needs is a most complex one and involves the consideration of a number of factors, all of which may have a profound effect on the yield of the resulting crop. The most important of these factors are dealt with briefly below.

Storing and Sprouting.—The use of sprouted tubers for "seed" is universally accepted throughout the world as being necessary to obtain the best results, and the practice offers the following advantages—(1) higher yields per acre are obtained; (2) earlier maturity of the crop is assured; (3) a more even growth and a better stand of plants in the field is obtained; (4) virus disease is checked, since those tubers having weak spindly sprouts, or showing other symptoms of the presence of virus disease are eliminated.

Great difficulty has been experienced in the past in finding a method of storage of "seed" tubers which will assure their being brought to the field in a satisfactory state for planting, owing to the early sprouting and rapid exhaustion of the tubers induced by the high temperatures of the early spring months. This difficulty has been particularly pronounced in the case of "early" and "mid-season" varieties, which have been imported and tested in the past, and has led to their being discarded.

One of the chief problems that confronts the grower of unirrigated potatoes in this country is that of keeping his seed potatoes from one season to the next, so that they shall be in the right condition when the planting time arrives. Usually under ordinary methods of storage the shoots are too long and weak, and the tubers are flabby, indicating that a large proportion of the food reserve for the young potato plant is already exhausted. Seed potatoes in such a condition will inevitably produce weak plants and give a poor yield of tubers per acre.

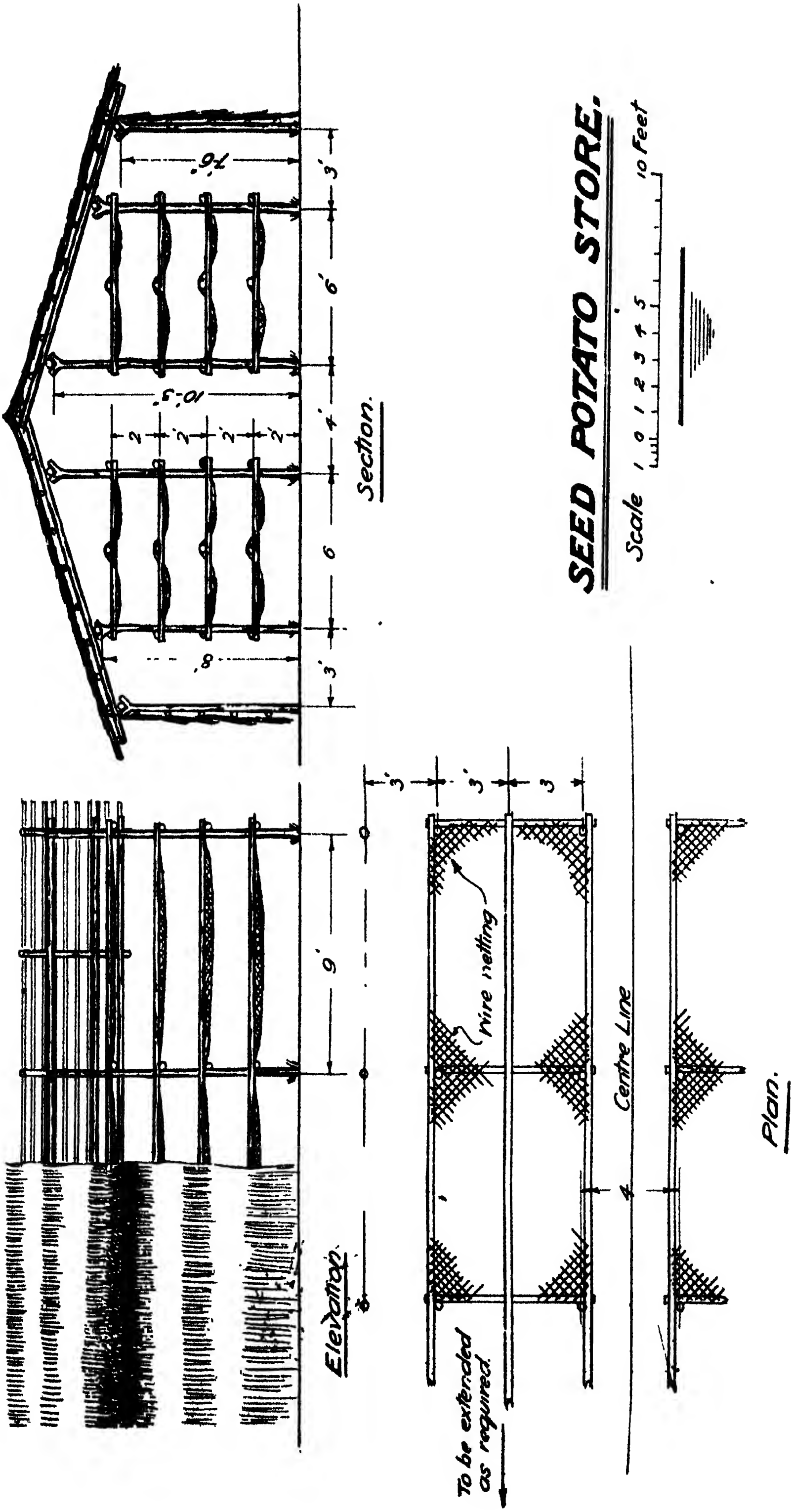
The following notes describe the most satisfactory method of storing seed potatoes which has been evolved by this Department after testing many methods.

Besides ensuring that the seed arrives at the field in excellent condition at planting time, this method of storage has the added advantage that it is cheap, and can be brought into operation by any farmer, using almost entirely materials available on his own farm.

The method is a very simple one, and consists essentially of a series of wire-netting racks or shelves, one above the other, on which the potatoes are placed and a shelter above and around the racks, which is covered with a light thatch of grass. Ordinary native timber, or gum poles, are used for the framework of the racks and the shelter over them.

Upright poles, having a fork at the upper end, are placed in the ground at distances of 9 feet and 6 feet apart, as seen in the plan and elevation sketches shown. The butts of the poles should be charred or treated in some way to prevent attack by white ants. Methods of treatment are given in Bulletin No. 512. The forks at the top of the uprights serve as supports for the purlins of the roof of the overhead shelter.

To these uprights, lighter poles are fixed so as to form the framework of horizontal shelves 2 feet apart. To this framework ½-1 inch wire netting is nailed to complete the shelves. It is convenient to construct these shelves in double rows with a 4 feet passage between them. The rows of shelves may be any length necessary to accommodate sufficient seed to plant the acreage of


SEED POTATO STORE.
Scale
10 Feet
Section.
Elevation.
Plan.
Wire netting
Centre Line
To be extended as required.

potatoes required. One shelf 9 x 6 feet will easily hold 1 bag of "seed" potatoes in a single layer, and 6 to 7 bags or about 1,000 lbs. of seed potatoes are required to plant one acre.

The potatoes may be stored in layers two deep on the shelves, but more than this is not advisable, as it would tend to prevent the free circulation of air and the ingress of light, and so lead to the production of long weakly shoots. Over the rows of shelves is constructed a shelter, covered with a light layer of grass. This shelter serves to protect the tubers from frost and rain. As the danger from frost passes the grass on the shelter should be thinned out, so as to allow the entry of light in order to restrict the growth of the shoots and keep them short and thick and green. The tubers should be watched carefully, and once they begin to sprout, the further growth of the shoots must be carefully controlled, as indicated above, by allowing the entry of more light and air.

The cost of the erection of such storage sheds should not be great, as most of the material is found on the farm, and as the sheds will remain serviceable for a number of years, the cost per acre of potatoes planted per year should be very small.

Two other methods of storage of seed are shown in the illustrations. In fig 1 the crates or boxes in which seed is imported are used and these are convenient for transporting the tubers to the field, but it does not allow of easy removal of rotten tubers. Fig. 2 explains itself. The surface of the earth is hard and bare.

Whatever system of storing tubers for sprouting is adopted, it must be designed to give protection from frost and sun-scald, and yet allow of the free play of air and light round the tubers when and as required and permit the seed to be easily looked over so that rotten tubers may be removed.

Potatoes cannot be stored in earth-covered "clamps" or in pits, as is done in Northern Europe. It was found at the Agricultural Experiment Station, Salisbury, that a covering of more than two inches of dirt caused potatoes to form long weak sprouts, and less than one inch of dirt failed to protect them from the heat of the sun in September and October.

Acceleration of Sprouting.—Farmers who grow potatoes under irrigation for the early market during the winter often have difficulty in securing sprouted "seed" for planting, or inducing their own "seed" to sprout sufficiently early. Some growers of main crop potatoes, too, who prefer to use "seed" grown under irrigation in winter, have a similar difficulty. This is, of course, due to the fact that the potato tuber requires to pass through a resting period of from two to four months after maturing, during which the "eyes" remain dormant. This dormant or rest period may be terminated by cutting the tuber in half transversely, as was shown by Appleman at the Maryland Experiment Station, but the use of "cut" seed is often inadvisable, and does not give such good results as whole sprouted "seed." A solution of this problem was discovered at the Agricultural Experiment Station, Salisbury, based on the original work of Van der Groot in Java.

The tubers are placed in an air-tight room, or receptacle, such as a corrugated iron tank, and fumigated with carbon

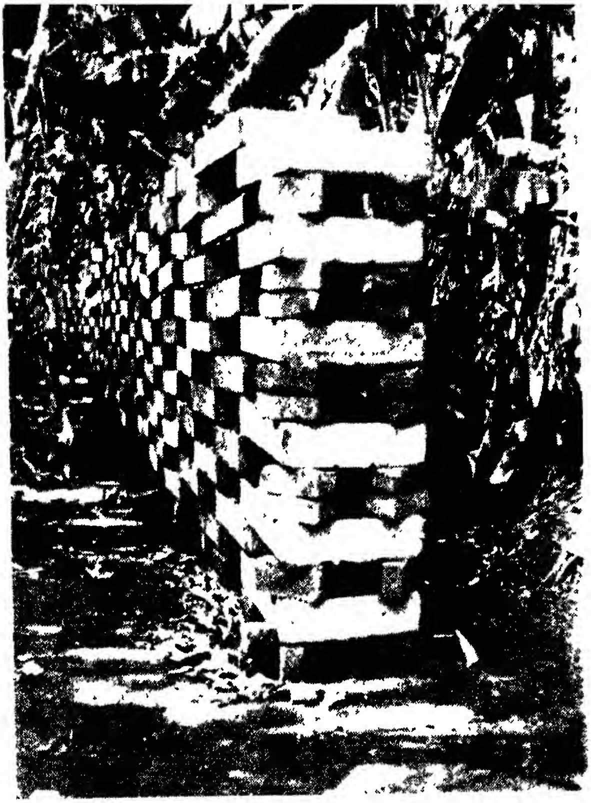


Fig 1
"Seed" potatoes stored in open wooden crates during winter under thick shade of plantains Glenara Farm, near Salisbury

Fig 2
Three hundred yards of "seed" potatoes under the shade of cypress trees at Glenara Farm, near Salisbury. The potatoes are in a single layer on the bare earth

bisulphide. A pit in the ground covered with a tarpaulin has not proved satisfactory, probably owing to the vapour being absorbed by the earth. On the other hand a tarpaulin covering to an iron tank would be satisfactory, since the vapour is 2.6 times heavier than air, and so will not tend to rise and find its way through the tarpaulin.

Carbon bisulphide should be placed in shallow trays or dishes on the top of the "seed" tubers and the room or receptacle closed. The liquid evaporates readily on a warm day, and the vapour being heavier than air, flows over the sides of the trays and fills the receptacle. It is advisable to commence the treatment on a warm morning, so that the liquid will evaporate rapidly. The tubers should undergo the treatment for 24 to 48 hours, and two tablespoonfuls of the carbon bisulphide are required to each cubic yard, or 27 cubic feet of volume of the receptacle, irrespective of whether the latter is filled with tubers or only partly so. Within ten days about 75 per cent. of the "seed" should be commencing to sprout. When sprouting has commenced, it may be further accelerated by placing the tubers in a gently warmed tobacco barn or in a warm room, in which the air is kept moist. It is useful to know that carbon bisulphide is sold by the pound weight. One pound is equivalent to approximately 13 ounces (liquid measure), or 26 tablespoonfuls. Those working on a small scale may note that a 45 gallon oil drum has a capacity of roughly a quarter of a cubic yard.

This method of accelerating sprouting has now been employed successfully by many farmers for a number of years, but care must be taken that an overdose is not given, since this may kill the terminal buds.

Recent research carried out by N. C. Thornton in America provides an explanation of the way in which carbon bisulphide brings about accelerated sprouting in potatoes, and at the same time points the way to safer and cheaper methods, which are now under investigation by this Department.

He demonstrated that "the failure of the potato buds (in freshly harvested tubers) to grow is due to the oxygen content of the air being too high . . . and that growth can be initiated at once, if the oxygen concentration is reduced from 20 per cent. (normal) to approximately 2 to 10 per cent." Freshly harvested tubers sprouted in seven days when kept in an atmosphere containing 5 to 10 per cent. of oxygen under moist conditions, as against 47 days when the percentage of oxygen was 20.

It appears probable, therefore, that the carbon bisulphide vapour in the method described functions through displacement of the air in the container, thereby reducing the percentage of oxygen present. It seems probable that the inert gas carbon dioxide could more safely and cheaply perform the same function, or that the burning of a lamp or candles in an air-tight container could be used to remove the surplus oxygen from the air, and achieve the same purpose.

Warning.—It should always be carefully borne in mind that the vapour of carbon bisulphide is highly inflammable and explosive. It is also poisonous, and the greatest care should be exercised in handling this material. No naked lights, not even

a lighted cigarette or tobacco pipe may be permitted anywhere in the neighbourhood of where it is being used. It is dangerous to switch on an electric torch in the presence of the vapour, since small sparks at the switch may cause an explosion. A room which has been filled with vapour should be left open to ventilate for several hours before it is entered.

Selection of "Seed" Tubers for Freedom from Disease.—All tubers showing any signs of "rot" or "scab" should, of course, be discarded at once.

Abnormally-shaped tubers should be rejected, since research has shown that such abnormal shape may be due to the presence of a virus disease called "Spindle-tuber," which causes a marked decrease in yield. The tubers become elongated towards the "heel," are often irregular in shape, and the "eyes" become deepened. Tubers with long spindly sprouts should be rejected, since they are invariably infected with the Leaf Roll form of virus disease. A further sign of this disease in the tuber may be seen when it is cut transversely near the heel end. A fine network of brown lines may be visible, this condition being known as "net necrosis."

In varieties normally having deep eyes, those tubers having shallow eyes should be discarded, since they may be "rogues," or may be infected with Mosaic. Splits, excavations and blisters on the surface of the tubers may be the signs of infection by a disease known as "Stipple Streak," and tubers showing these symptoms should be rejected.

Although one or two of the diseases mentioned above have not so far been reported in this Colony, their appearance may be expected and guarded against as far as possible. Unfortunately it cannot be considered that if tubers show no signs of virus infection such as those mentioned above, they are therefore free from it. Disease cannot be eradicated by tuber selection, but its extent and spread may be materially reduced thereby.

Use of Immature Seed and Effect of Locality of Origin.—It is the almost universal custom amongst British growers of "seed" potatoes to lift their crops whilst the tubers are still immature. Generations of experience have shown that immature seed gives better results than seed allowed to mature in the ground, but the true explanation of this phenomenon is still in doubt. It may be due to some intrinsic value which immature seed possesses, or it may be due to the immature seed being freer from infection by virus disease. Both opinions have their supporters, but, as pointed out by Salaman,† "In practice it makes but little difference whether the improvement in yield obtained by the use of immature seed is ascribed to its immaturity or to its freedom from virus infection."

Size of Seed.—The most suitable size of seed has a weight varying between 1½ ozs. and 2½ ozs. In size these limits roughly lie between that a small "native" hen's egg and the large egg of a good heavy breed of poultry.

Since a decrease in the size of the tubers is one of the principal symptoms of an increase in virus disease in any strain

†"Potato Varieties," by Redcliffe N. Salaman.

of imported seed, then the longer that strain has been grown in the Colony the larger should be the average size of the "seed" tubers selected for planting.

The best way to select "seed" tubers is by the "hill" method. The crop is lifted row by row, and "seed" of the proper size should only be taken from those plants which have given a high yield of good sized tubers, which are of normal shape and appearance.

The Cutting of Seed.—The cutting of seed in this Colony is not recommended, except in an emergency. When it becomes necessary, owing to shortage of seed, the tubers should be cut longitudinally through the "rose" end. The cut should not be completely through the tuber, but should stop a quarter of an inch short, leaving the two halves still joined by a small portion of uncut tissue. A thin knife, such as a worn table knife, is most suitable. After cutting place the tubers in the shade, and cover them with old sacking, which should be kept moistened with water, until the corky layer has formed over the cut surfaces, which happens in a few days. The sacking is then removed. The halves can then be severed from each other and are ready for planting, but it is best to cut seed 2 or 3 weeks before planting to enable bad sets to be sorted out. It may be mentioned that cutting accelerates the sprouting of tubers.

Cutting should always be done in the shade, and the sets should be kept in the shade and not bagged, until they are planted.

Weight of Seed per Acre.—From 1,200 to 2,700 lbs. of seed tubers between 2-2½ ozs. in weight are required to plant an acre, varying with the planting distances and the average weight of seed used. The weights of seed required for some of the commoner spacings is given in the following table:—

		Bags of 150 lbs. (approx.)
36 x 15 inches—2 oz. seed—1,452 lbs.	—	10
36 x 15 inches—2½ oz. seed—1,815 lbs.	—	12
36 x 18 inches—2 oz. seed—1,210 lbs.	—	8
36 x 18 inches—2½ oz. seed—1,512 lbs.	—	10
30 x 12 inches—2 oz. seed—2,178 lbs.	—	14
30 x 12 inches—2½ oz. seed—2,722 lbs.	—	18
30 x 15 inches—2 oz. seed—1,742 lbs.	—	12
30 x 15 inches—2½ oz. seed—2,184 lbs.	—	14
30 x 18 inches—2 oz. seed—1,452 lbs.	—	10
30 x 18 inches—2½ oz. seed—1,815 lbs.	—	12

Degeneracy and Selection.—Recent research carried out in Great Britain has shown, as already mentioned above, that tuber selection within a variety *that is free from virus disease* does not affect the yield of the crop. This is what one would expect, since the method of reproduction is a vegetative one. But when the crop is infected with virus disease then a quite different state of affairs results, and selection of tubers properly carried out will go far to maintain the yield of the crop by reducing or restricting the extent of the infection.

It is very doubtful if any imported seed arrives in this Colony completely free from virus infection, but it is quite certain that after it has been grown in this Colony for two or three years, *degeneration of the yield due to virus disease is rapid if proper selection methods are not practised.* Selection of seed from a bulked crop solely according to size, tends to cause a rapid increase of the virus diseases, since one of the principal symptoms of such diseases is an increase in the proportion of small tubers borne by a plant, and it is these small tubers which are used for seed.

If, however, selection of seed is done each year in the field from highly-yielding plants which show no signs of infection by virus disease, a high level of yield may be maintained, as has been demonstrated at the Agricultural Experiment Station, Salisbury. During the season (1930-31) the following results were obtained. The yields are given in bags of 150 lbs. per acre, and are the means of four plots:—

Seed—1st generation from imported seed.	Seed—9th generation from imported seed. Carefully selected.	Seed—9th generation from imported seed. *Not* selected carefully
140	124	41

These results are impressive and require no comment. They demonstrate clearly that careful methods of selection will assure the maintenance of a high level of yield. Figures 4 and 5 (August issue, 1931, R.A.J.) illustrate pictorially the advantages of selection of tubers from healthy plants as against the neglect of this practice. These are photographs of two of the plots in the experiment just quoted.

Advice on the proper methods to employ can be obtained from the Department of Agriculture.

Mundy* quotes the case of one Southern Rhodesian farmer who had raised over 20 consecutive crops from the original imported seed. He states: "This gentleman has irrigated land and claims that the alternation of summer and winter crops is all the change needed" to ensure the maintenance of the vigour of the crop. There is no doubt that winter-grown crops of potatoes are less infested with aphis and other possible insect vectors of virus diseases, and it is highly probable, if not certain, that seed from a winter-grown crop will be freer from virus infection than that from a summer-grown crop. For these reasons it would appear likely that the more elevated portions of the Colony on the Eastern border, where irrigation is available for growing the crop in winter, could supply seed of high quality for the remainder of the country, and this would save much of the expenditure laid out each year on the importation of seed from Scotland. This matter is now under investigation by this Department, and preliminary results are promising.

The degeneration of a variety of potatoes from the date of importation of "seed" into this Colony is almost entirely due to increasing infection by virus diseases. The virulence of these

*"Sub-Tropical Agriculture."—H. G. Mundy.

virus diseases is probably enhanced in Southern Rhodesia by the high temperatures obtaining during the summer growing season.

Cultivation.—Where planting is done before the arrival of the the rains in spring, the ridges should be pulled down and levelled again. This facilitates the killing of weeds and the maintenance of a loose mulch by means of drag harrows before the plants appear above ground. This is the cheapest and best method of killing weeds, and can be continued until after the first leaves of the plants are above ground. If the lands are quite free from trash, as they should be, and if the soil is not too wet and sticky, these types of harrow and also, particularly, the walking weeders, will not injure the young plants if the work is done in the heat of the day.

As soon as the lines of the potatoes can be easily seen, cultivation should be carried on between the rows as often as is necessary completely to control weeds and keep the soil loose and friable. The potato crop cannot withstand competition from weeds, and it must be kept free from them. At first, cultivation should be deep and close to the plants, as their roots are still short and not easily damaged, but later cultivations must be quite shallow, and great care must be taken to avoid injury to the root system and the breaking off of young tubers, which commence to form before the crop begins to flower.

After the crop is about 12 to 15 inches high, it should be ridged up with a light ridging plough. From this time onwards it should need little attention beyond a further ridging by hand hoe or plough, when great care should be taken that the soil is placed round the stems of the plants, *and that any cracks appearing in the soil are filled up so as to prevent the entry of tuber moth*, and to protect the tubers from exposure to light, which causes them to turn green.

Under Irrigation.—Cultivation of the soil after planting the crop under irrigation must necessarily be done by hand, since the ridges cannot be broken down. Continued cultivation must be done to keep the surface of the soil from "crusting" and cracking, and to kill all weeds. On the heavier soils, particular care must be taken that cultivation is not done too soon after irrigation, owing to the danger of packing the soil, and thus causing malformed tubers and making the subsequent lifting of the crop difficult.

Irrigation of the Crop.—During the early growth of the crop it should not be heavily irrigated, as this discourages the development of the root system both in regard to depth and extent.

Sufficient water should be led on at the first irrigation, immediately after planting, to bring the potatoes above ground. In some particularly porous soils, with abnormal sub-soil drainage, this is not possible, and further irrigation may be necessary, but the water-holding capacity of such soils can be improved year by year by building up the humus supply by means of applications of compost or kraal manure, or by green-manuring during the summer.

After the crop becomes well established and growing strongly, the soil should be maintained in a moist condition, as the presence

of ample moisture, without excess, is essential if the potato plant is to obtain its food supply easily, and keep up the continuous rapid growth which is so necessary with the winter-grown crop in order to catch the early market.

The need of potatoes for a uniform distribution of water is shown by the results of a five years' experiment carried out in Utah, where it was shown that one inch of water weekly, or a total of 12.8 inches during the season, gave a higher yield than any other treatment.*

The soil should never be allowed to dry out, as, with extremes of drought and moist conditions alternating, irregular growth and malformation of the tubers will result. *Furthermore, if the soil is allowed to dry out and crack open, this will allow the easy ingress of the tuber moth, the worst pest of the potato crop.* The period when the crop makes its biggest demands on the water supply is from just before flowering until maturity, as it is then that the tubers are growing, and during this time an ample supply of water must be maintained.

Injury by Frost.—An experienced grower of potatoes under irrigation, in an article published in the "Rhodesia Agricultural Journal," states "constant watering, I have found, helps to prevent frosting. This may be an empty theory of mine. I do not contend that in this way lands which have no protection from frost are thereby made frost-proof, but where only mild frosts are felt it certainly does help." Whether this is so or not, the writer is unable to say, but it would appear to be a point worthy of consideration by other growers.

The grower who takes a chance with the frost by planting a portion of his crop in late July and early August, and is caught by a late frost, need not give up all hope of a crop. Mr. E. G. Raubenheimer, of Umvuma, had this experience in 1940. His potatoes were completely cut down by the frost when the haulms were about 12 inches high, and even the underground portion of the haulms was blackened and killed. These facts were observed by an officer of this Department who carefully examined them.

On the advice of his brother, who had had a similar experience in the past, he continued to irrigate the apparently dead crop, which came again, and grew out into an excellent crop, giving a good yield of sound potatoes.

It should be mentioned that they were irrigated on the morning of the day following the severe frost which cut them back.

Economy of Irrigation Water.—Many growers are faced with a possible shortage of water for irrigation towards the end of the winter, and must economise their supply in every possible way. This can be assisted in many cases by increasing the humus supply in the soil by green-manuring the land in summer and by the application of heavy dressings of compost or farmyard manure, where this is feasible.

Deep and thorough preparation of the soil, down to a depth of ten inches or more where local conditions allow, and the use of Martin and similar cultivators for breaking up the subsoil, will

*"Agricultural Meteorology," by S. Warren Smith.

Fig 4
Crop from "seed" of strain selected for eight years for high yield, large size of tubers and freedom from disease Yield per acre 138 bags Agricultural Experiment Station, Salisbury "Selection Trials for Maintenance of Yield"

Fig 5
Crop from "seed" of strain which has not been selected for high yield It has degenerated in size of tubers and yield per acre, due to virus diseases Yield per acre, 45 6 bags This strain and that shown in Fig. 4 have been grown from the same original stock imported in 1923. Agricultural Experiment Station, Salisbury "Selection Trials for Maintenance of Yield"

help in the economy of water, because this extends the feeding range of the root system, and encourages its development, and also because the increased aeration of the soil renders available more of the reserve plant food in the soil.

Heavy dressings of the necessary fertilisers will also assist to economise water, as the transpiration ratio of a crop varies inversely with the fertility of the soil. In an infertile soil the crop must take in much larger quantities of water, carrying plant food in solution, to obtain its food requirements, than in a fertile soil. Constant attention to the maintenance of a loose mulch on the surface of the soil, by killing weeds, is also of assistance.

Harvesting.—The main crop is not harvested as a rule until the haulms have completely died off and may be safely left in the ground through the winter until early spring, *but the greatest care should be taken to see that all cracks in the soil are filled in so as to prevent the entry of the tuber moth.* As soon as the haulms are dead they should be pulled off, and the holes left in the tops of the ridges by their removal should be carefully filled in with soil. The entry of light through cracks in the soil also causes the tubers to become green in colour. Winter crops are not as a rule left in the ground to mature thoroughly, but are lifted as early as possible to catch the early market. Irrigated potatoes, obviously, cannot be left in the ground to keep for any length of time and must be lifted before the first rains in spring. They do not keep quite so well as main crop potatoes, and need greater care in handling during lifting as they are more easily bruised. Before bagging they should be allowed to dry off in the shade for 48 hours. This is of particular importance with the irrigated crop. The tubers should not be left exposed to the sun after lifting owing to the danger from scalding by the sun and subsequent rotting.

The crop may be lifted by hand by means of the 4-prong vine hoe, or by means of a ridging plough. On the heavier soils in this Colony, the special types of potato-digging machinery have not given good results, but some of the types of ridging ploughs fitted with two sets of shaking prongs behind the plough are being used with success. The shaker prongs are removable and the implement can then be used as an ordinary ridging plough. One grower who used this type of lifting plough reports that he has lifted two acres of a heavy crop of potatoes in two hours, the implement being pulled by a medium-powered tractor in top gear. Six oxen are sufficient to pull it, but do not do such good work as the tractor, owing to the slower pace at which they travel. The soil on which the above result was obtained is a medium red loam.

Pests of the Crop.—The principal pests of the potato crop in this Colony are cutworms, tuber moth and eelworms (*Heterodera radicicola*). Cutworms may be destroyed by poison baiting before planting, as described in Departmental Bulletin No. 665, but after the plants are up, hand-picking the caterpillars from the soil around the stems of the plants appears to be the only practicable measure.

Methods of control of eelworms were discussed in an article which appeared in the "Rhodesia Agricultural Journal" of September, 1927, page 957, and reprinted as Bulletin No. 654. They

do not as a rule cause serious trouble to early planted winter-grown crops, but may cause great loss to summer crops, and in fact may make it impossible to grow a profitable crop of potatoes. They are particularly troublesome on irrigated land, and may make such land useless for the production of potatoes or any other susceptible crop.

Where eelworms are known to be present in the soil, the only green manure crop at present commonly grown in this Colony which can be recommended for preceding a potato crop, or to be included in a rotation with potatoes, is sunnhemp. This crop is immune from eelworm attack, and for this reason, in addition to others mentioned in the paragraph on green-manuring, it is advisable always to use sunnhemp as a green manure for potatoes, since a farmer may not know until the damage is done that his soil is becoming infested with the pest, and the use of a susceptible crop such as dolichos beans or sunflowers may enormously increase a slight infestation.

Farmers are particularly warned against the use of dolichos beans for green-manuring potato land infested with eelworms, since several growers have had a disastrous experience with it and their potato crops have been ruined by the pest. Other susceptible green manure crops are sunflowers, white stingless velvet beans, kaffir beans and soya beans.

The tuber moth probably causes more damage to the potato crop than any other pest in this Colony. The eggs are laid on the tuber and the full-grown caterpillar makes its way to the surface of the soil. The adult moths may infest other tubers of the growing crop by entry into the soil through cracks. It is therefore of the greatest importance that all cracks in the soil should be closed by constant cultivation, and as soon as the crop matures and the haulms die off, the latter should be pulled off and the holes left in the soil by their removal should be filled in by drag-harrows or by hand hoes. "Seed" tubers are always liable to become infested, and it is one of the advantages of early planting of the crop in dry soil before the arrival of the rains, that the burying of the tubers in the soil protects them from infestation by this pest. "Seed" tubers may be treated with carbon bisulphide fumes to kill the larvæ of the moth before planting, in the same way as is described elsewhere for the acceleration of sprouting of "seed" tubers, but the effect of this treatment is incomplete.

Diseases.—It is not proposed to discuss the question of the diseases of the potato, since the subject is dealt with in Departmental Bulletin No. 1188, but the writer would like to take this opportunity of emphasising the advantages to be reaped in the increased yields of potatoes obtained by spraying or dusting the growing crop to control the "early blight" disease. Growers in this Colony are still very backward in this matter, *and are urged to give the matter their immediate attention.*

Yields and Marketing.—The average yield per acre throughout the Colony is very low. The reason for the low average yields is undoubtedly due to the crop being grown largely under unsuitable conditions, or because it has not received the proper treatment. That yields from the main crop of 100 to 120 bags (of 150 lbs. each) per acre are obtainable over considerable acreages when the crop

receives proper treatment is being amply demonstrated by the principal growers each year, and yields of 200 bags per acre have been obtained by one grower of irrigated winter potatoes. Naturally the yields per acre vary in accordance with the rate of application of manures and fertilisers, but it may be said that on average red soil, with a dressing of 10 to 15 tons of compost or kraal manure and 600 lbs. per acre of a complete fertiliser having a 20-4-8 analysis, yields of 80 to 120 bags of potatoes per acre should be obtained in the summer season, if the crop receives proper cultural treatment.

Before marketing the crop, it should be carefully graded according to size, and any potatoes showing the least blemish should be discarded. The question of proper grading is of the utmost importance, and the greatest care should be given to the handling of the crop when lifting it and when grading and handling prior to marketing, to avoid any blemishes on the tubers, which will reduce the price obtained very considerably.

The best prices are obtained for the early crop grown in the winter, which comes on the market after the main crop has been exhausted. As a general rule the first of the "early" crop is not on the market before the middle of September, though a few which have been planted with the last summer rains and finished under irrigation will be on offer before this date.

Everything that can be done throughout the growing and handling of the winter crop to bring it on the market earlier should be done, as the prices obtained for the first of the early crop are so much higher as a rule than those for the main crop or the later supplies of the early crop.

SUMMARY.

1. Cull potatoes are a valuable feed for all adult stock, but contain too little protein for young growing stock or laying hens.

2. The potato prefers a deep, free-working, cool and fertile loam, but can be grown on any soil not infertile, if well drained and if humus and fertiliser are supplied.

3. The potato is a delicate feeder with a delicate root system; therefore a thoroughly and deeply prepared seed-bed is essential to success. For the same reasons and because its growing season is so short in this Colony, it must have an ample food supply in an easily available form.

4. Organic matter in the soil in ample quantities is essential to success, and it may be supplied in the form of compost, farmyard manure and green manure.

5. Maintain tilth on irrigated land by green-manuring in the summer with sunnhemp sown broadcast at the rate of 40 lbs. per acre. Plough under the green manure sufficiently early to allow it to rot thoroughly before planting potatoes.

6. If heavy dressings of compost are applied, the chief fertiliser required is a readily available form of phosphate such as superphosphate. Dressings of 500 to 600 lbs. per acre of 20 per cent. super are suitable. With light dressings of compost or where kraal manure is used, dressings of 500 to 800 lbs. per acre of a complete potato fertiliser may be applied.

7. Farm or kraal manure must be thoroughly rotted. Apply heavy dressings before ploughing, and lighter dressings in the furrows. Fertilisers may be applied in the furrow at planting, but should not come in direct contact with seed. Only readily available forms of fertiliser should be used, but success cannot be expected with fertilisers alone. Plant in furrows 30 to 36 inches apart and 12 to 18 inches between plants in the rows, according to fertility of soil, rate of application of fertiliser and vigour of seed.

8. Keep furrows as near contours as possible on irrigated land.

9. If soil is heavy and liable to pack when moist, plant in dry soil in October-November, but then planting must be deep so that there is at least 5 inches of soil above the top of the seed.

10. Planting behind a 3-furrow plough is very unsatisfactory. Three methods of planting the irrigated crop are described. Plant main crop from October to December and irrigated crop from March to August if land is frost-free, but not before August if frost may be severe.

11. After planting the main crop before the rains, flatten the ridges and keep the land quite free of weeds by the use of light drag-harrows and chain-harrows. These and walking weeders can be used until the first few leaves of the plants are above ground.

12. Continue cultivation between the rows as soon as they are easily seen. Kill all weeds and keep surface soil loose and friable. Cultivate deeply at first, but later cultivations must be shallow and carefully done to avoid damage to young tubers and roots. Ridge up the rows when plants are about 12 to 15 inches high, and control weeds by hand hoeing. Fill all cracks in soil and holes around stems to prevent entry of tuber moth and light. Under irrigation, take care not to cultivate too soon after irrigation on heavy soils; any crust formed should be broken up at once by hand hoeing.

13. Do not irrigate too heavily during early growth; later, maintain soil in moist condition but not too wet. Never allow soil to dry out. The crop needs most water from before flowering until maturity. Economise irrigation water by maintaining an ample supply of humus in the soil and by deep and thorough preparation of the soil before planting.

14. A supply of the best available seed is the most important item in potato growing. Use sprouted seed with short sturdy green sprouts and greened tubers. Seed will keep well if stored in shallow layers, exposed to free circulation of air and subdued light.

15. Sprouting can be accelerated by treatment with carbon bisulphide vapour, and further accelerated by placing in a warm tobacco barn or room. Reject all seed showing any signs of disease or abnormality of sprouts.

16. With "first or second from imported" seed, which is more or less free from virus diseases, 2 oz. seed is sufficiently large, but with seed more remote from importation and infected with virus disease, large seed will probably pay best—up to 2½ ozs. and even larger.

17. Small whole tubers give better results than halves of large tubers. If necessary to cut seed, cut in halves longitudinally through rose end, and plant only in moist soil. Never plant cut seed in dry soil unless irrigated at once.

18. From 1,200 to 2,700 lbs. seed per acre are required according to spacing and size of seed.

19. Harvest main crop after haulms are all dead. Remove dead haulms and fill in holes left in soil, and all cracks, to prevent entry of tuber moth. The crop can be safely left in the ground until July or August.

20. Control cutworms by poison-baiting and hand-picking. Prevent tuber moth infestation by planting main crop early and by preventing entry by holes and cracks in soil. Carbon bisulphide fumes will kill most of larvæ in seed potatoes.

21. Spray or dust your potatoes during critical period of growth to control early blight, and so extend the growing period and largely increase yield of crop.

22. Carefully grade your crop for market according to size. Remove all tubers having any blemish. This is essential to obtaining good prices.

Rhodesian Milk Records.

SEMI-OFFICIAL. COMPLETED LACTATIONS.

Name of Cow.	Breed.	Age.	Milk in lbs.	B. Fat in lbs.	Average % B. Fat.	No. of Days.	Name and Address of Owner.
No. 285	G. Friesland	4 years	7386.10	243.26	3.29	300	A. Stokes Esq , Safago, Gwelo.
No. 286	G. Friesland	4 years	6290.00	202.55	3 22	300	
No. 302	G. Friesland	3 years	5825.60	213 67	3.67	300	
No. 287	G Friesland	4 years	4645.50	217.14	4 68	300	
No. 183	G Friesland	Mature	8235 70	273 51	3.32	300	
No. 187	G. Friesland	Mature	7691 40	263.48	3.43	283	
No. 274	G. Friesland	4 years	5533 50	213 93	3.87	300	
No. 228	G. Friesland	Mature	6267 70	229 21	3.66	300	
No. 203	G. Friesland	Mature	6389 80	221 74	3 47	217	
No. 202	G. Friesland	Mature	6854 40	262.10	3.82	261	
No. 284	G. Friesland	4 years	5364 00	203 60	3.79	300	
No. 279	G. Friesland	4 years	5868 70	200.22	3.41	300	
No. 288	G. Friesland	4 years	5820 90	202 64	3.48	300	
Sir Nels Futurity II of Shanks	P.B. Guernsey	Mature	5009 70	208 61	4.16	242	
No. 19	G. Friesland	Mature	7453.90	312 99	4 20	300	
No 174	G Friesland	Mature	7752 90	257.88	3 33	276	
No. 233	G. Friesland	Mature	6835 70	242.56	3.55	259	
Flora of Safago	G. Guernsey	3 years	4614 80	210.67	4 57	300	
Carmen of Delectus	G. Guernsey	4 years	6213.90	301.35	4.85	291	
No. 222	G. Friesland	Mature	8651 90	282.75	3.27	286	
No. 237	G Friesland	4 years	6867.10	230.08	3.35	263	
No. 209	G. Friesland	Mature	8075.50	351.71	4.35	300	
No. 120	G. Friesland	Mature	10133 10	344.25	3.40	300	
No. 85	G. Friesland	Mature	7014 00	223.94	3.10	183	
Gowerhill Pauline	G. Friesland	Mature	7014.00	223.94	3 19	183	Messrs. Gowerhill Dairy, P O. Box 1143, Salisbury.
Violet's Fanny of Rynheath	P.B. Guernsey	3 years	6049 50	257 13	4.25	300	A. F. H Valentine, Umtali
Mischief	G. Friesland	Mature	5564 00	269.31	4.84	300	
Pansy II of Rynheath	P.B Guernsey	3 years	3684.00	200.50	5.44	300	
Ness	G. Friesland	Mature	5631.70	200.59	3.56	278	M. Huxham Esq., "Spitzkop," Mazoe.
Styx	G. Friesland	Mature	5143.90	234.78	4.56	278	
Mina	G. Friesland	Mature	8003.00	290.05	3.62	300	F. Neill Esq , Box 455, Salisbury
Jessie	G. Friesland	Mature	5831.00	212.38	3.64	283	
Nancy	G. Friesland	Mature	7242.00	283 37	3.91	257	
Chikoopoo	G Friesland	Mature	5943.50	200 14	3.37	262	
Mona	G. Friesland	Mature	4832.00	203 74	4.22	293	F. Grossman Esq., Kenilworth, Rusapi

Pat	G. Friesland	Mature	5288 50	207.73	3.93	269	Union and Rhodesia, Mining and Finance Co., Ltd., Salisbury.
Zakayu	G. Friesland	Mature	6168 30	240.23	3 89	300	W. F. H. Soutt, Maple Leaf, Norton.
Mary	G. Friesland	4 years	5177.10	216 51	4.18	300	
Mazon	G. Friesland	3 years	5622.50	231.51	4.12	276	
Leman	G. Friesland	Mature	7526 10	268 94	3.57	300	
Scones	G Friesland	Mature	9999 30	357.73	3.58	300	
Chicongiwe	G Friesland	4 years	6942.20	283.06	4.08	300	
Mgode III	G. Friesland	Mature	7411 10	281.71	3.80	300	
Betiya	G. Friesland	4 years	7105 40	279.12	3.93	300	
Zabeta	G. Friesland	Mature	5237.80	211.13	4 03	252	
Zaminwe	G. Friesland	Mature	7458.00	296.58	4.00	264	
Mjaya	G Friesland	4 years	7141 10	270 33	3 79	300	
Steria	G Friesland	Mature	5563.00	215.36	3.87	300	J. G. Thurlow, Atherstone, Bindura.
Longfere	G Red Poll	Mature	4795 90	202 34	4 22	300	
Amandas	G. Red Poll	Mature	5310 60	231 24	4.16	300	
Vinegar	G. Red Poll	4 years	6241 60	229 72	3 68	300	
Nyanedzi	G. Shorthorn	Mature	5812 20	236.16	4 06	300	
Highness	G Friesland	4 years	6134 50	235.16	3.83	300	V. A. Lawrence, Knockmaroon, Norton.
Chitema	L R Shorthorn	Mature	6000 00	240.73	4.01	300	G R Morris, Box 1040, Salisbury.
Nasibawda	G. Guernsey	Mature	5096 50	229.79	4.51	300	
Chiromo	G Guernsey	Mature	4566 50	251 72	5 51	277	
Jene	G Guernsey	Mature	3686.00	210.60	5.71	284	
No. 106	G Friesland	Mature	6283 60	211 72	3.37	276	H A. Day Esq , Box 1153, Salisbury.
No. 64	G Friesland	Mature	6099 80	256 31	4 20	275	
No. 55	G Friesland	Mature	5765 20	224.52	3.90	276	
No. 124	G. Friesland	Mature	6891.70	261.70	3 80	293	
No. 54	G. Friesland	Mature	6084 40	223 98	3.68	300	
No. 82	G. Friesland	Mature	6714.90	257 18	3 83	300	
No. 5	G Red Poll	Mature	6374 80	234 52	3 68	300	
No. 132	G Friesland	Mature	6955 30	275.24	3 96	300	
No A. 90	G Friesland	Mature	6797.80	269 43	3 96	300	
No. A. 39	G Friesland	Mature	8856 60	293 21	3 31	300	
No A. 57	G Friesland	Mature	8091.00	253 28	3.13	300	
Violet	G. Shorthorn	Mature	5946 20	224 20	3 77	294	D. J. Huddy, Granville, Salisbury.
Whisky	G Friesland	Mature	6795 40	239 12	3 52	262	
No. 3	P.B. Ayshire	Mature	7677 90	269 65	3 54	273	
Blackie	G. Friesland	Mature	7439 40	214 92	2 89	224	
Stembok	G. Friesland	Mature	6658 90	237 30	3.56	274	
Dora	G. Friesland	Mature	6398 40	209 75	3 29	268	
Induna	G. Friesland	Mature	5135 30	211 59	4.12	277	
Pansey	G Shorthorn	Mature	6433 70	220 07	3 42	256	
G. Petal	G. Red Poll	3 years	5654 10	218 61	3.87	300	G. N Fleming, Box 688, Salisbury.
G. Stella	G. Red Poll	3 years	5533 70	203 00	3 60	300	
G. Prudence	G. Red Poll	Mature	5015.80	203.82	3.99	300	

SEMI-OFFICIAL.—(Continued).

Name of Cow.	Breed.	Age	Milk in lbs.	B. Fat in lbs.	Average % B. Fat.	No. of Days.	Name and Address of Owner.
Chume III	G. Friesland	Mature	5977 30	248.75	4.16	300	Messrs. Red Valley Estate, Lushington, Marandellas.
Mary III	G. Friesland	Mature	7673.60	316.55	4.13	292	
Plenty	G. Friesland	Mature	8066.10	288.70	3.58	300	
Pandora	P B Friesland	Mature	7316.70	252.74	3.45	300	
Protein	G. Friesland	Mature	6038.90	224.76	3.72	300	
"P" Ebony I	G. Friesland	Mature	6701.50	239 52	3.57	300	
Molly II	G. Friesland	Mature	9369.80	304 46	3.25	300	
Jessie	G. Friesland	Mature	5281 30	204 51	3.87	222	
Paddock	G Friesland	Mature	6790.30	238.63	3.51	300	
Outspan I	G. Friesland	4 years	5465.70	223.54	4.09	243	
Guinnes I	G Friesland	3 years	7028.20	219.70	3.13	300	
Gov'ment	G. Friesland	Mature	7366.10	276.79	3 76	300	
Jaine	G Friesland	Mature	4693 50	214.06	4.56	252	
Margaretta II	G Friesland	Mature	5417 10	225 97	4.17	238	
Pretoria	G. Friesland	Mature	6360 60	224.80	3.53	300	
Bunty	G. Friesland	Mature	5022 30	218 86	4.36	300	Capt. W. Nash, Marandellas.
Raye	G. Friesland	4 years	5554 20	238.70	4.30	300	
Florence II	G Friesland	4 years	5284.70	215.60	4.08	300	
Cress II	G Friesland	4 years	5319 70	224 74	4 23	300	
Shealagh	G Friesland	3 years	5348.40	200 11	3.74	300	
Sharp	G Friesland	Mature	6413 10	320.70	5.00	300	
Doris	G Friesland	Mature	6063 00	282 16	4.65	300	
Cordellia	G. Friesland	4 years	5986 10	214.16	3.58	300	
Mary Rose	G Friesland	4 years	5564 40	231 85	4 17	288	
Shirley	G Friesland	Mature	6889 70	273 21	3.97	300	
Flora	G Friesland	Mature	4523 80	216 01	4 77	300	
Pinkie	G. Red Poll	Mature	8280.50	143.91	4 12	300	K M. Campbell, Hedon Farm, Marandellas.
Bluebell	G Friesland	Mature	5068 50	218.22	4.31	223	
Morag	G. Red Poll	Mature	4864 50	229.58	4.72	300	
Ginger	G Friesland	Mature	7305.50	258.51	3 54	300	
Peggy	G. Red Poll	Mature	7049 50	274 63	3.90	300	
Polly	G. Red Poll	Mature	6053.00	235 08	3.88	300	
Pamela	G. Red Poll	Mature	5339 50	200 97	3.75	300	
Gracie	G. Friesland	Mature	4793 50	209.54	4.38	300	
Doreen	G. Red Poll	Mature	4514 50	206 78	4.58	300	
Margaret	G. Red Poll	3 years	5023 00	233 14	4.64	283	
Val	G. Friesland	Mature	6601 30	228 89	3.47	300	J. R. Bedford, Poltimore, Marandellas.
Ray	G. Guernsey	Mature	5351.00	277 03	5 18	300	
Quilts	G. Friesland	Mature	7154.50	297.49	4.16	300	

Alice	G. Friesland	4 years	7548 00	306.08	4 06	300	J. R. Bedford, Poltimore, Marandellas
Iris	G. Shorthorn	Mature	8081 40	270.86	3.35	300	
Rosie	G. Friesland	Mature	6519.40	221.95	3 40	300	
Kerry	G. Guernsey	Mature	5608 70	237 08	4.23	300	
Rita	G. Friesland	Mature	8116 30	339 40	4.18	300	
Star	G. Shorthorn	Mature	7031 30	276.63	3.94	300	
Chingoriwa	G. Shorthorn	Mature	4572 90	204 84	4.48	300	
Vixen	G. Guernsey	Mature	6083.50	233.65	3.83	300	
Helen	G. Guernsey	Mature	5416 70	252.35	4.66	300	
Jillian	G. Guernsey	Mature	7386 80	304 66	4.13	300	
Peggy I	G. Guernsey	Mature	7080 30	266 82	3.77	300	
Gertie	G. Friesland	Mature	6093 50	219.89	3.61	291	Hon. H. V. Gibbs, Bonisa, Redbank.
Pat	G Friesland	Mature	6613 70	229.25	3 47	300	
Fanny	G Friesland	Mature	8256 00	280.22	3.39	300	
Vera	G. Red Poll	Mature	5693.80	258.68	4.54	300	
Jill	G. Friesland	Mature	6545 70	237 89	3.63	300	
Lorena	G Friesland	Mature	4957.50	207.28	4.18	300	
Grace	G. Friesland	Mature	11701.40	346.15	2.96	300	
Marlene	G. Friesland	Mature	5761 40	343.65	4.23	300	
Lina	G. Friesland	Mature	6198 00	224.68	3.63	300	
Fuss	G Friesland	Mature	5715 30	202 42	3.54	300	
Girl	G. Friesland	Mature	6241 30	213.47	3.42	300	
Dolly	G. Friesland	Mature	6361.30	236.08	3.71	300	
Rose	G. Red Poll	Mature	6469 80	227.79	3.52	300	
Ella	G. Friesland	Mature	5801.00	235 12	4.05	300	
Janet	G. Friesland	Mature	8812 90	253.11	2.87	300	
Evelyn	G. Red Poll	Mature	5675.90	216 57	3.82	272	
Fraser	G. Friesland	4 years	8467 90	247 97	2.93	300	
Roma	G. Friesland	Mature	5197.10	293 63	3.92	300	T. Cousins Esq., Oaklands, Gwelo.
Jade	G. Friesland	Mature	7576 20	207.39	2.74	300	
Sister	G. Friesland	Mature	8210 50	285.50	3.48	300	
Bramble I	G. Friesland	2 years	9756 90	325.76	3.34	300	
Patricia	G. Friesland	Mature	5867 50	227.78	3 88	300	
Duchess	G. Friesland	4 years	7550 10	232 82	3.08	300	
Dina	G. Friesland	Mature	5617 50	200.81	3.58	278	W. D. Haywood, Ordoff Farm, Gatooma.
Pumpkin	G. Guernsey	4 years	5585 00	239.61	4.29	300	
Bess II	G. Guernsey	Mature	5960 20	220 82	3.70	300	
Boots	G. Guernsey	3 years	5250.70	230.47	4.39	282	
Puza	G. Guernsey	Mature	5111.10	200.68	3 93	274	
Doris	G. Guernsey	Mature	4355 20	171 96	3.95	259	
Bat	G. Guernsey	4 years	3663 40	129 62	3.54	244	
Primrose	G. Guernsey	Mature	5244 40	204.91	3.91	275	
Beauty	G. Guernsey	3 years	3604 50	146.41	4.06	283	

SEMI-OFFICIAL.—(Continued).

Name of Cow.	Breed.	Age.	Milk in lbs.	B. Fat in llbs.	Average % B. Fat.	No. of Days.	Name and Address of Owner.
Wendy	G. Friesland	4 years	5451 60	211.56	3.88	280	T. Cousins Esq., Oaklands, Gwelo.
Rosemary	G. Friesland	Mature	6753.40	260.33	3.86	300	
Spot	G. Friesland	Mature	8299.60	341.43	4.11	300	
Pixie	G. Friesland	Mature	7156.90	246.09	3.44	300	
Blanco	G. Friesland	Mature	8148.20	281.36	3.45	300	
Dulcie	G. Friesland	Mature	7806 60	254 36	3.26	300	
Rosie II	G. Friesland	Mature	5591.40	221.50	3.96	267	
Daft	G. Friesland	Mature	5798.90	212.01	3.66	300	L. T. Tracey, Handley Cross, Chakari.
Silly	G. Friesland	Mature	4846 10	204.77	4.23	300	
Susan	G. Friesland	Mature	6047.00	240 59	3.98	300	Commander E. L. Morant, Box 741, Salisbury.
Lucy	G. Ayshire	Mature	5794.08	207.77	3.41	300	
Lavender	G. Ayshire	Mature	4128.00	206 86	5.01	237	
Whinburn Zephyr	G. Friesland	4 years	5503.20	202.51	3.68	290	Major R. R. Sharp, Whinburn, Redbank.
Whinburn Midge	G. Friesland	Mature	10283 50	356.57	3.47	300	
Whinburn Echo	P.B. Friesland	Mature	6106.00	225.63	3.70	300	
W. Frivolity	P.B. Friesland	Mature	9210.20	277.02	3.01	300	
No. 95	G. Red Poll	Mature	5363 50	210.14	3.92	300	A. M. Tredgold, P.B. 61 L., Bulawayo.
No. 78	G. Red Poll	Mature	4757.00	200 34	4.21	300	
No. 20 T.B.	G. Red Poll	Mature	5255 00	208.21	3.96	300	
Sabina	G. Friesland	Mature	7773 00	286.38	3 68	300	W. E. Tongue, Box 199, Bulawayo.
Dimity	G. Friesland	4 years	5966 00	205.26	3.44	300	
Beatrix	G. Friesland	Mature	9204 00	306 00	3.32	300	
Darby	G. Friesland	Mature	9043.00	319.20	3.53	300	
Susan	G. Friesland	4 years	8166 00	255 23	3.13	300	
Yeo	G. Friesland	Mature	8549.00	277.26	3.24	300	
Jeanette	G. Friesland	3 years	7321.00	269.76	3.69	300	
Kuku	G. Friesland	Mature	9705 00	313.26	3.23	300	
Lassie	G. Friesland	3 years	7741 00	240 66	3 11	300	
Jay	G. Friesland	3 years	6501.00	234 53	3.60	300	
Kitty	G. Friesland	Mature	11118 00	344 33	3.10	300	
June	G. Friesland	Mature	8790 00	284.66	3 24	300	
Kikuyu	G. Friesland	3 years	7499 00	282.60	3.77	300	
Jess	G. Friesland	3 years	7277 00	313 15	4.30	300	
Kirstie	G. Friesland	4 years	11121.00	369 59	3 32	300	
Dewdrop	G. Friesland	Mature	9079.00	300.05	3.30	300	
Daisy II	G. Friesland	3 years	5595 00	266 75	4 77	277	

No. 68	G. Red Poll	Mature	6645.10	260 60	3.92	300	Rhodes Matopo Estate, P.B. 19 K., Bulawayo.
No. 107	G. Red Poll	Mature	6001.80	258.44	4 31	300	
No. 101	G. Red Poll	Mature	6029 40	222.03	3.69	300	
No. 97	G. Red Poll	Mature	5643.20	208 39	3.69	300	
No. 96	G. Red Poll	Mature	6161.30	283.40	4.60	300	
Gundaan	G. Friesland	Mature	6716 70	246.11	3.66	300	P. Freeland, Lingfield, Gwelo.
Peach	G. Friesland	Mature	7163.30	269.09	3.76	300	
White II	G Friesland	Mature	8354.10	168 49	3.21	300	
No. A. 21	G. Friesland	Mature	6444 20	219 35	3.40	300	
No. A. 42	G. Friesland	Mature	7128 30	231 08	3.24	300	
J. 8	G. Friesland	Mature	6829.90	264.53	3.87	247	A L. Bickle, Box 595, Bulawayo.
J. 47	G. Friesland	Mature	7169 10	243 95	3.42	250	
J. 50	G. Friesland	Mature	9924 30	263 06	2.65	230	
J. 18	G. Friesland	Mature	7611.80	272.75	3.58	241	
No. 70	G. Friesland	Mature	7783 00	232.50	2.96	237	
D. 4	G. Friesland	3 years	6051.30	217 15	3.54	300	
J. 46	G Friesland	Mature	6172.70	227.85	3.69	252	
J. 36	G Friesland	Mature	6452.40	220.18	3.41	277	
No. 69	G. Friesland	Mature	6311.20	218.71	3.47	258	
J. 55	G Friesland	4 years	6839.60	224.06	3.28	286	
J. 25	G Friesland	Mature	8251.30	353.14	4.28	300	
J. 43	G Friesland	Mature	7666 90	255.67	3.33	300	
Margaret	G. Friesland	4 years	7955 30	258 51	3.25	300	W Sole Esq., Bauhinia, Glendale
Sylvia	G. Friesland	4 years	6777.10	250 69	3 70	300	
Joyce	G. Friesland	Mature	10943 50	439.66	4.02	300	
Saidie	G. Friesland	Mature	8560.80	301.66	3.53	300	
Patience	G. Friesland	Mature	8466.80	295 03	3.50	300	
Molly	G. Friesland	Mature	6154.60	211 50	3 44	300	
Pauline	G. Friesland	4 years	6418.30	244 74	3.81	300	
Rebecca	G. Friesland	Mature	9788 30	400 60	4.09	300	
Rosemary	G. Friesland	4 years	7498 60	257 27	3 43	300	
Flower	G. Friesland	4 years	8222.50	296.53	3 61	300	
Kanawet	G. Ayshire	Mature	5640 00	228 26	4.05	300	W E. Tapson Esq., Lesape Falls, Rusapi.
Blanket III	G. Ayshire	2 years	6639 50	229 63	3 40	300	
Matope	G. Friesland	Mature	8791 00	332.68	3.78	300	
Bandit I	G. Friesland	Mature	6496 50	214 13	3.30	300	
Beans II	G. Friesland	4 years	4930 00	225 90	4.58	300	
Blanket II	G Friesland	Mature	6296 50	201 00	3.19	291	
Giridia I	G Ayshire	Mature	7203 50	296 58	4.12	300	
Daisy	G Ayshire	Mature	5785 50	253.50	4 38	300	
White	G. Friesland	Mature	6339 50	258.22	4.07	288	
Ngamera	G Ayshire	Mature	5240 50	209 83	4.00	270	
Wasikana	G Ayshire	Mature	5647.00	236.40	4.19	296	
Castor Oil	G. Ayshire	Mature	5940 50	246 13	4.14	269	
Dany	G Friesland	Mature	6379 50	226.57	3.55	274	
Dashupiga	G Ayshire	Mature	5258.00	211.86	4.03	270	

SEMI-OFFICIAL.—(Continued).

Name of Cow.	Breed.	Age.	Milk in lbs.	B. Fat in lbs.	Average % B. Fat.	No. of Days.	Name and Address of Owner.
Spot II	G. Friesland	Mature	7253.00	274.66	3.79	275	C. Boyd Clark, Castle Zonga, Inyazura.
True Girl	G. Friesland	Mature	6701.50	224.79	3.36	291	
Betty	G. Friesland	Mature	5579.50	207.56	3.72	242	
Carpet	G. Friesland	Mature	5840.00	218.79	3.75	254	
Laura	G. Friesland	Mature	5445.00	203.83	3.74	255	
Bonnie I	G. Friesland	Mature	5550.00	209.97	3.80	243	
Violet II	G. Friesland	Mature	6185.00	217.51	3.52	242	
Catherine III	G. Friesland	Mature	7304.50	246.54	3.37	275	
Pansy	G. Friesland	Mature	6213.00	232.84	3.75	269	
No. 267	G. Friesland	Mature	6156.50	226.16	3.67	300	Coldstream Dairy, Headlands.
No. 174	G. Friesland	Mature	6483.50	241.61	3.73	300	
No. 131	G. Friesland	Mature	5204.00	248.75	4.78	300	
No. 233	G. Friesland	Mature	6893.50	203.62	2.95	288	
No. 356	G. Friesland	3 years	6630.00	282.02	4.25	300	
No. 372	G. Friesland	3 years	7273.50	298.38	4.12	300	
No. 290	G. Friesland	Mature	6537.00	247.44	3.78	240	
Larkhill Daphne	G. Red Poll	Mature	5528.30	202.20	3.66	300	Major A. H. McIlwaine, Larkhill, Marandellas.
Melfort Coral	G. Devon	Mature	5173.40	229.02	4.43	277	
Gamble	G. Ayshire	Mature	4620.00	211.90	4.58	300	Major F. H. R. Maunsell, Forres, Bromley.
No. 164	G. Friesland	Mature	9420.00	303.82	3.22	300	Meikle Bros., Leachdale, Shangani.
No. 332	P.B. Friesland	Mature	7728.00	230.72	2.99	300	
No. 368	P.B. Friesland	Mature	10503.00	321.43	3.06	300	
No. 170	G. Friesland	Mature	7922.00	260.75	3.30	300	
No. 181	G. Friesland	Mature	10968.00	355.80	3.24	300	
No. 209	G. Friesland	Mature	6796.00	237.66	3.50	300	
No. 132	G. Friesland	Mature	10413.00	357.40	3.43	300	
No. 163	G. Friesland	Mature	13909.00	405.00	2.91	300	
No. 17	G. Friesland	Mature	8883.00	265.99	2.99	300	
G. 4/7	G. Friesland	4 years	7662.00	270.90	3.54	300	
No. 14/7	G. Friesland	3 years	6655.00	237.76	3.57	300	
G. 210	G. Friesland	3 years	9259.00	290.31	3.14	300	
G. 211	G. Friesland	3 years	7550.00	265.05	3.51	300	
No. 112	G. Friesland	Mature	7180.00	259.02	3.61	300	
No. 148	G. Friesland	Mature	9645.00	313.72	4.25	285	
No. 2/7	P.B. Friesland	3 years	6581.00	223.17	3.39	300	
No. 391	P.B. Friesland	Mature	7196.00	242.07	3.36	292	
No. 191	G. Friesland	Mature	8302.00	269.37	3.24	300	

Annetta I	P.B. Friesland ...	Mature	9995.00	314.91	3.15	300	W. S. Mitchell, "Springs," Iron Mine Hill.
Annette .. .	G. Friesland	Mature	8728.00	304.34	3.49	300	
Annetta III .	P.B. Friesland ..	Mature	8237.50	282.04	3.42	300	
Annetta II . ..	P.B. Friesland .	Mature	7133.50	221.09	3.10	240	
Destiny B. ..	P.B. Friesland ...	Mature	7761.00	300.87	3.88	270	
Dignity B. II .	P.B. Friesland .	3 years	7399.00	256.23	3.46	300	
S.R. Dignity	G. Friesland ...	Mature	11603.50	394.34	3.39	300	
Dorina A.	P.B. Friesland ..	3 years	6525.00	253.30	3.88	300	
Sheep Run Dainty	P.B. Friesland .	Mature	9201.50	316.85	3.44	300	
Sheep Run Destiny S.R.	P.B. Friesland	Mature	10985.50	388.05	3.53	300	F. B. Morrisby, Sunnyside, Gwelo.
S.R. Lily	P.B. Friesland	Mature	6607.00	242.98	3.68	279	
S.R. Dignity C. ..	P.B. Friesland	Mature	8126.50	282.44	3.48	300	
S.R. Dorina .. .	P.B. Friesland	Mature	9273.00	349.34	3.77	300	
S.R. Lady	P.B. Friesland	Mature	11108.50	373.90	3.37	300	
S.R. Louisa ..	G. Friesland ...	Mature	5914.50	213.50	3.61	250	
Annetta	P.B. Friesland	Mature	10472.50	314.20	3.00	287	
Destiny "C" . ..	P.B. Friesland	4 years	6587.50	234.92	3.57	300	
No. 88	G. Friesland ..	Mature	7323.00	212.58	2.90	300	
No. 41 ..	G. Friesland .	Mature	10149.00	321.29	3.17	300	
No. 61 . . .	G. Friesland .	Mature	8187.00	262.60	3.21	300	
No. 126 .	G. Friesland . .	3 years	6703.00	208.85	3.12	300	
No. 29	G. Friesland .	Mature	8893.00	287.68	3.24	300	
No 65 . .	G. Friesland	Mature	8341.00	293.73	3.52	283	
No. 27 . .	G. Friesland	Mature	9278.00	270.05	2.91	300	
No. 123 ..	G. Friesland	3 years	8285.00	206.79	2.50	300	
No. 52 .	G. Friesland	Mature	6473.00	222.12	3.43	289	
No. 15 .	G. Friesland	Mature	10398.00	307.07	3.04	300	
No. 28	G. Friesland .	Mature	6513.00	219.65	3.37	262	
No 57 ..	G. Friesland	Mature	7264.00	209.01	2.88	300	
Sally .	G. Friesland	Mature	8432.00	312.27	3.70	300	
Bunch	G. Friesland	3 years	7438.00	220.98	2.97	300	
Puff .	G. Friesland	3 years	9128.00	280.25	3.07	300	
Snug ..	G. Friesland	Mature	10065.00	344.82	3.43	300	
No. 114	G. Friesland	3 years	5948.00	174.60	2.94	300	
No 99 .	G. Friesland .	Mature	7277.00	252.67	3.47	300	
No. 26 .	G. Friesland	Mature	9348.00	294.88	3.15	300	
No. 86 .	G. Friesland .	4 years	6662.00	244.17	3.67	300	
No. 0 .	G. Friesland .	Mature	7315.00	244.74	3.35	300	
No. 85 .	G. Friesland	Mature	8689.00	285.38	3.28	300	
No. 109 .	G. Friesland	3 years	7572.00	236.39	3.12	300	
No. 35	G. Friesland	Mature	7853.00	280.68	3.57	300	
No. 60 ..	G. Friesland . .	Mature	9376.00	307.85	3.28	300	
No. 68 ...	G. Friesland .	Mature	7161.00	255.96	3.57	300	
No. 53	G. Friesland	Mature	12688.00	356.70	2.81	300	

Name of Cow.	Breed.	Age.	Milk in lbs.	B. Fat in lbs.	Average % B. Fat.	No. of Days.	Name and Address of Owner.
No. 45	G. Friesland	Mature	10213.00	306.40	3.00	300	F. B. Morrisby, Sunnyside, Gwelo.
No. 23	G. Friesland	Mature	8222.00	266.92	3.25	300	
No. 22	G. Friesland	Mature	8417.00	302.89	3.60	300	
No. 73	G. Friesland	Mature	6751.00	220.59	3.27	300	
No. 44 ...	G. Friesland	Mature	7150 00	275 27	3.85	300	
Brimula ...	G. Friesland	Mature	9024.00	323.13	3 58	300	
Prudette	P.B. Friesland	Mature	8988 00	279.23	3.11	300	
Amy of Tolosa	P.B. Friesland	Mature	9541.00	336.08	3.52	300	
No. 27	G. Friesland	Mature	6614.00	225.16	3.40	300	Mrs. E. N. Lamb, Box 815, Salisbury.
Masweena	G. Red Poll	4 years	5004.00	234.97	4 69	300	
Baxter I	G. Red Poll	Mature	7541.00	300 21	3.98	300	
Dinah ...	G. Friesland	Mature	6469 50	250.09	3.86	300	
Surie ..	G. Red Poll	Mature	5321.00	207.79	3.91	287	
Malindi	G. Friesland	Mature	7261.00	231.70	3 19	300	
Red Roy ..	L R. Shorthorn	4 years	5026.00	203 13	4.04	300	
No. 13 ..	G. Friesland	Mature	9951.50	323 14	3 25	300	Mazoe Citrus Estate, P.O. Mazoe.
Sekerland	G. Friesland	Mature	6047.00	240.59	3.98	300	J. A. Baxter, Box 1368, Salisbury.
Skami leg	G. Friesland	Mature	7237 40	240.89	3 33	300	
Edwin ..	G. Friesland	Mature	8299 90	253.57	3.06	300	
Rhodean ..	G. Friesland	3 years	6379.00	215 11	3.38	300	
Jani	G. Friesland	Mature	7176.60	276.49	3 85	252	
Chemini II	G. Friesland	Mature	7082.50	229.43	3.21	300	
Aussie White	G. Friesland	3 years	6144.50	207.50	3.38	300	
Steamer	G. Friesland	4 years	5886.40	233 82	3.97	300	
Motor II	G. Friesland ..	Mature	6152.80	241.61	3.93	300	

Departmental Bulletins.

Copies of these Bulletins may be obtained from the Editor, Box 387, Salisbury. They are issued to residents of Southern Rhodesia at a charge of 3d. per copy and at 6d. per copy outside the Colony.

N.B.—The date the article appeared in the Journal is indicated in abbreviated form before the number, e.g., 8/22, No. 429, means that Bulletin 429 appeared in the Journal for August, 1922.

AGRICULTURE AND CROPS.

7/25. No. 545. Artificial or Synthetic Farmyard Manure, by H. G. Mundy, Dip.Agric., F.L.S.

5/27. No. 643. Noxious Weeds in Southern Rhodesia, by F. Eyles, Botanist.

12/27. No. 663. The Use of Fertilisers and Manures in Southern Rhodesia, by A. D. Husband, A.I.C., Chief Chemist.

2/28. No. 674. Top Dressing of Maize against Stalk Borer, by H. C. Arnold.

3/28. No. 681. The Sunflower (Helianthus Annuus) (Revised), by S. D Timson, M.C., Dip.Agric.

6/28. No. 695. The Castor Oil Plant (Ricinus spp.), by S. D. Timson, M.C , Dip.Agric.

9/28. No. 705. Suggested Cropping Programmes for Farms on the Sand Veld, by D. E. McLoughlin, Assistant Agriculturist.

10/28. No. 710. Monthly Reminders for the Farming Year, by the Division of the Chief Agriculturist.

3/29. No. 727. Farmyard Manure, by A. P. Taylor, M.A., B.Sc., Agricultural Chemist.

7/29. No. 743. Sunn Hemp, by S. D. Timson, M.C., Dip.Agric.

9/29. No. 751. The Sweet Potato, by S. D. Timson, M.C., Dip.Agric. (Wye).

10/29. No. 758 Instructions for Taking Soil Samples. Issued by the Division of Chemistry.

1/30. No. 768. The Ground Nut (Arachis hypogaea), by S D. Timson, M.C., Dip.Agric (Wye).

3/30. No. 776. Regulations Governing the Export of Maize and Maize Meal through the Port of Beira.

11/30. No 797. Green Manuring: An Essential Practice in Rhodesian Farming, by H. G. Mundy, Dip.Agric. (Wye), F.L.S., Chief Agriculturist.

1/31 No. 802. Witch Weed, by S. D. Timson, M.C., Inter.B Sc (Agric.) London., Dip.Agric (Wye), Assistant Agriculturist.

3/31. No. 815. New Strains of Oats for Southern Rhodesia, by H. C. Arnold, Manager, Agricultural Experiment Station, Salisbury.

4/31. No 816. Preliminary List of the more Common Grasses of Southern Rhodesia, by Sydney M. Stent, Botanist for Pasture Research.

5/31. No. 822. Re-stacking of Maize rejected for Export on account of Excessive Moisture.

9/31. No 826. Some Poisonous Plants of Southern Rhodesia, by Sydney M. Stent, Senior Botanist.

10/31. No. 831. Revised Notes on Cotton Growing in Southern Rhodesia, by G. S. Cameron.

11/31. No. 836. The Potato, by S. D. Timson, M C., Dip.Agric. (Wye)

12/31. No. 837. Veld Grass Silage: A Feature in Rhodesian Pasture Management, by H. G. Mundy, Dip.Agric. (Wye), F.L.S., Chief, Division of Plant Industry.

6/32. No. 855. Pigeon-hole Method of Stacking Maize, by Division of Plant Industry.

8/32. No. 859. Twenty-one Years of Plant Introduction, by Major Mundy, Chief Division of Plant Industry.

2/33. No 878. A.I.V. Silage: Memorandum prepared and circulated by Imperial Bureau of Animal Nutrition.

11/34. No. 936. Witchweed, by S. D. Timson, M.C. Dip.Agric. (Wye), Assistant Agriculturist.

8/35. No. 961. A Home-made Ridger. Contributed by Mr. Douglas Aylen, Somerset, Concession.

10/35. No. 970. Rhodes Grass for the Southern Rhodesian Tobacco Grower, by African Explosives and Industries, Ltd.

11/35. No. 972. Notes on Witchweed, by S. D. Timson, M.C., Dip.Agric. (Wye), Assistant Agriculturist.

6/36. No. 991. Silage and Silos.

6/36. No. 992. Annual Report of the Agriculturist for the year 1935, by D E. McLoughlin, Agriculturist.

8/36. No. 997. Reward Wheat: Report on the Baking Properties and Chemical Analyses, by The Rhodesian Milling and Manufacturing Co , Ltd.

4/37. No. 1022. Smut Diseases of Wheat in Southern Rhodesia, by G. M. Wickens, B.Sc. Agric., Ph.D., D.I C., Plant Pathologist, Tobacco Research Station, Trelawney.

9/37. No. 1044. Farming Calendar.

10/37. No. 1046. Green Manuring: Two Important Factors Affecting Success, by S. D. Timson, M.C., Assistant Agriculturist, and H. C. Arnold, Manager, The Agricultural Experiment Station.

4/38. No. 1067. Grass Mowers, by H. Beynon, from "The Farmer," March 4th, 1938.

10/38. No. 1084. Improved Pastures, by S. D. Timson, M.C., Assistant Agriculturist.

11/38. No. 1089. Witchweed and the Labour Shortage, by S. D. Timson, M.C., Assistant Agriculturist.

2/39. No. 1101. Grass Silage, by H. C. Arnold, Manager, Salisbury Experiment Station

6/39. No. 1113. Wheat Production in Southern Rhodesia, by D. E. McLoughlin, Agriculturist.

10/39. No. 1129. Pyrethrum, by H. C. Arnold, Manager, Agricultural Experiment Station, Salisbury.

11/39. No. 1131. Witchweed, by Division of Agriculture.

12/39. No. 1136. Compost, by S. D. Timson, M.C., Assistant Agriculturist

1/40. No. 1137. Compost Notes, by S. D. Timson, M.C., Assistant Agriculturist.

5/40. No. 1153. Field Selection of Seed Maize, by Alan Rattray, Junior Agriculturist.

7/40. No. 1157. Some Hints for Cotton Growers, by G. S. Cameron, Empire Cotton Growing Corporation.

7/40. No. 1158. Kudzu (*Pueraria Thunbergiana*), Cultivation and Propagation, by H. C. Arnold, Manager, Salisbury Experiment Station.

10/40. No. 1164. New Strains of Velvet Beans, by H. C. Arnold, Manager, Agricultural Experiment Station.

10/40. No. 1165. Soya Beans: Notes on Cultivation, by H. C. Arnold, Manager, Salisbury Experiment Station.

11/40. No. 1166. Good Haystacks must Resist Weather Damage: Modern Methods of Stacking, by G. J. Firman, Ganmain.

5/41. No. 1173. Agricultural Experiment Station, Salisbury: Annual Report of Experiments, Season 1939-40, by H. C. Arnold, Manager.

7/41. No. 1176. Costings of Farm Operations on the Witchweed Demonstration Farm, Auchendinny, Season 1939-40, by S. D. Timson, Asst. Agriculturist, and G. L. Black, Dip. Agric. (Durham), Manager.

9/41. No. 1183. Soya Beans, Results of Trials Season 1940-41, by H. C. Arnold, Manager, Salisbury Experiment Station.

11/41. No. 1185. Cutting Seed Potatoes, by H. C. Arnold, Manager, Agricultural Experiment Station.

1/42. No. 1194. Garden Compost, by S. D. Timson, M.C., Asst. Agriculturist.

8/42. No. 1206. The Potato (*Solanum tuberosum*): Methods of Cultivation in Southern Rhodesia, by S. D. Timson, M.C., Assistant Agriculturist.

REPORTS ON CROP EXPERIMENTS.

7/27. No. 649. Annual Report of Experiments, 1925-26, Agricultural Experiment Station, Salisbury, by H. C. Arnold, Manager.

4/28. No. 683. Annual Report of Experiments, 1926-27, Agricultural Experiment Station, Salisbury, by H. C Arnold, Station Manager.

7/29. No. 745. Salisbury Agricultural Experiment Station Annual Report, 1927-28, by H. C. Arnold.

7/30. No. 789. Agricultural Experiment Station, Salisbury. Annual Report of Experiments, 1928-29, by H. C. Arnold.

9/31. No. 830. Salisbury Agricultural Experiment Station, Annual Report, 1929-30, by H. C. Arnold, Manager.

10/32. No. 864. Annual Report, 1930-31: Agricultural Experiment Station, by H. C. Arnold, Station Manager.

6/33. No. 895. Salisbury Agricultural Experiment Station Annual Report, 1931-32, by H. C. Arnold, Manager.

3/34. No. 914. Gwelo Municipal Demonstration Station: Final Report, 1933, by S. D Timson, M.C., Dip.Agric (Wye), Assistant Agriculturist

9/35. No 965 Salisbury Agricultural Experiment Station Annual Report, 1933-34, by H. C. Arnold, Manager.

5/39. No. 1110. The Management and Utilisation of Natural Pastures, by H. C. Arnold, Manager, Salisbury Experiment Station.

4/40. No. 1149. Salisbury Agricultural Experiment Station: Agriculturist's Annual Report on Experiments, Season 1938-1939, by H. C. Arnold, Manager.

5/41. No. 1173. Agricultural Experiment Station, Salisbury: Annual Report of Experiments, Season 1939-40, by H C Arnold, Manager.

5/42. No. 1204. Agricultural Experiment Station, Salisbury: Annual Report of Experiments, Season 1940-41, by H C. Arnold, Manager.

TOBACCO.

8/26. No. 605. Flue-curing Tobacco Barns, Bulking and Grading Sheds, by P. H. Haviland, B.Sc. (Eng.), Acting Government Irrigation Engineer

9/26. No. 615. The Culture of Virginia Tobacco in Southern Rhodesia: Field Management, by D. D Brown.

5/27. No. 641. The Handling, Grading and Baling of Cured Virginia Tobacco, by D. D. Brown.

5/27. No. 644. Tobacco Baling Boxes, by B. G Gundry, Irrigation Branch.

11/27. No 661. Flue-curing Tobacco Barns, 12 ft. x 12 ft. x 16 ft., by B. G. Gundry.

1/28. No. 665. Tobacco Pests of Rhodesia, by Rupert W. Jack, F.E.S., Chief Entomologist.

2/28. No. 671. Wildfire and Angular Spot of Tobacco, by J. C F Hopkins, B.Sc., A.I.C.T.A.

12/28. No. 715. Turkish Tobacco Culture in Southern Rhodesia, by D. D. Brown, Chief Tobacco Expert.

3/29. No. 728. Suggested Crop Rotations for Tobacco Growers, by D. D. Brown, Chief Tobacco Expert.

4/29. No. 734. Common Faults in Curing Virginia Bright Tobacco, by D. D. Brown, Tobacco and Cotton Expert.

2/30. No. 771. Dark Fire-cured Tobacco: Field Operations, by D. D. Brown, Chief Tobacco Expert.

3/30. No 774. Dark Fire-cured Tobacco: Harvesting and Curing, by D. D. Brown, Chief Tobacco Expert.

6/30. No. 784. Field Control of Frenching in Tobacco, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Plant Pathologist.

11/31. No. 835. Tobacco Culture: Transplanting Operations, by D. D. Brown.

3/32. No. 846. Leaf Curl in Tobacco, by Dr. H. H. Storey.

3/33. No. 885. Tobacco Culture in Southern Rhodesia: The Harvesting and Curing of Virginia Tobacco, by D. D. Brown, Chief Tobacco Officer.

12/36. No. 1009. Tobacco Research on the Trelawney Station 1935-36 Season.

4/37. No. 1025. Report of the Tobacco Research Board, by Chas. K. Brain, M.A., D.Sc., Director of Agriculture and Chairman of the Tobacco Research Board.

8/37. No. 1039. Some Tobacco Pests that can be serious, by M. C. Mossop, M.Sc., Entomologist, Department of Agriculture.

1/38. No. 1054. Alkalinity of Tobacco Seed-bed Soils, by A. P. Taylor, M.A., B.Sc., Agricultural Chemist.

3/38. No. 1063. A New and Serious Disease of Tobacco in Southern Rhodesia, by G. M. Wickens, Ph.D., D.I.C., Plant Pathologist, Tobacco Research Station, Trelawney.

6/38. No. 1072. Report of the Tobacco Research Board for the year ending 31st December, 1937, by Chas. K. Brain, M.A., D.Sc., Director of Agriculture, and Chairman of the Tobacco Research Board.

5/40. No. 1154. Host Plants of the Tobacco Aphis (*Myzus persicae*), by Chas. K. Brain, M.A., D.Sc.

8/40. No. 1160. The Tobacco Aphid, by Rupert W. Jack, Chief Entomologist.

12/40. No. 1167. Turkish Tobacco: Culture and Marketing in Southern Rhodesia, by J. C. Collins, B.Sc., Assistant Tobacco Officer.

12/40. No. 1168. Field Spraying of Tobacco: Reports from Demonstration Plots, by J. C. F. Hopkins, D.Sc. (Lond.), A.I.C.T.A., Senior Plant Pathologist, Department of Agriculture.

9/41. No. 1181. Tobacco Culture in Southern Rhodesia: Seed-beds, by D. D. Brown, Chief Tobacco Officer.

11/41. No. 1187. The Culture of Virginia Type Tobacco in Southern Rhodesia: Field Operations, by D. D. Brown, Chief Tobacco Officer.

LIVE STOCK

1/27. No 624. The Construction of Dipping Tanks for Cattle (Revised)

1/31. No. 801. Sheep Farming in the Melsetter District, by J. C. Kruger, Part-time Sheep Adviser in the Melsetter District.

12/32. No. 871. Some General Observations on the Feeding of Dairy Cows on a Mixed Stock Farm, by Dr. A. E. Romyn, Senior Animal Husbandry Officer.

4/33. No. 887. The Type of Chiller Steer required for Export, by A. E. Romyn, Senior Animal Husbandry Officer.

9/33. No. 903. The Handling, Preparation and Chilling of Cattle for Export, by C. A. Murray, Lecturer in Animal Husbandry.

12/33. No 907 The Blackhead Persian: Its Breeding and Management in Matabeleland, by C. A. Murray, M.Sc., Lecturer in in Animal Husbandry, Matopo Estate.

1/34. No. 909. Stall Fed Chillers for the Overseas Christmas Market, by C. A. Murray, M.Sc., Animal Husbandry Officer, Matopo School of Agriculture and Experiment Station, Rhodes Matopo Estate.

2/34. No. 912. Economical Winter Rations for Wintering Dairy Heifers, by C. A. Murray, M.Sc. (Agric), Lecturer in Animal Husbandry, Matopo School of Agriculture.

4/34. No. 916. Cowpea Hay in the Ration for Bacon Pigs, by C. A Murray, M.Sc. (Agric.), Lecturer in Animal Husbandry, Matopo School of Agriculture and Experiment Station.

6/34. No. 924 Raising Dairy Calves on a Limited Amount of Whole Milk, by C. A. Murray, M.Sc, Agr, Animal Husbandry Officer, Matopo School of Agriculture and Experiment Station, Rhodes Matopo Estate.

1/35. No. 943. Cattle Improvement and a Cattle Breeding Policy in Southern Rhodesia: A Review of the General Position Chiefly as regards Ranching Cattle, by Dr. A. E Romyn, Chief Animal Husbandry Officer

1/35. No. 945 A Home-made Cow Stanchion, by Major R. R. Sharp, Whinburn, Redbank

5/35. No 952. Annual Report of the Chief Animal Husbandry Officer for the year ending 31st December, 1934, by A. E Romyn, Chief Animal Husbandry Officer.

7/35. No 959. The Selection of a Dairy Bull, by A. E. Romyn, Ph.D., Chief Animal Husbandry Officer

4/36. No. 984. Report on the Curing of Rhodesian Hides, by Advisory Committee on Hides and Skins of the Imperial Institute.

4/36. No 985. Export of Frozen Porkers. Third Consignment to Smithfield. Division of Animal Husbandry.

5/36. No. 987. The Curing of Hides and Skins on the Farm, by The Division of Animal Husbandry.

5/36. No. 988. Preparing Cattle for Show, by The Animal Husbandry Division.

6/36 No. 989 The Supplementary Feeding of Mineral and Protein Supplements to Growing Cattle in Southern Rhodesia and its Relation to the Production of Beef Steers, by C. A. Murray, M Sc. (Agric.), Senior Animal Husbandry Officer in Charge, Rhodes Matopo Estate; A. E Romyn, Ph.D., Chief Animal Husbandry Officer, Department of Agriculture, Southern Rhodesia; D. G Haylett, Ph D, Director, Rhodes Matopo Estate; F. Ericksen, Dip Agric, Experimentalist

3/37. No. 1021. Breaking in Young Oxen to the Yoke, by J. B. West, Dromoland, P.B. Lonely Mine

4/37 No 1023. Cowpea Molasses Silage for Fattening Steers, by C A Murray, M.Sc. (Agric.), Senior Animal Husbandry Officer in Charge, Matopo School of Agriculture and Experiment Station; A. E. Romyn, Ph.D., Chief Animal Husbandry Officer, Department of Agriculture, Salisbury; R H. Fitt, Dipl. Agric., Animal Husbandry Officer, Department of Agriculture, Salisbury.

4/37. N. 1024. Comparative Feeding Value of Maize Meal and Nyouti (*Pennisetum Typhoides*) Meal for Fattening Steers, by C. A. Murray, Senior Animal Husbandry Officer in Charge, Rhodes Matopo Estate; A. E. Romyn, Chief Animal Husbandry Officer.

5/37. No. 1029. The Dehorning of Cattle intended for Slaughter and Export, by B. A. Myhill, Assistant Chief Veterinary Surgeon.

5/37. No. 1030. The Feeding of Different Winter Supplements to young growing steers and the effect of these supplements on the subsequent development and costs of production of the steers, by C. A. Murray and A. E. Romyn.

6/37. No. 1032. The Effects of Feed on the Firmness and Grading of Bacon Carcases, an experiment carried out by the Division of Animal Husbandry in co-operation with Mr. A. L. Millar, Estes Park, Salisbury, and Mr. Frank Neill, of Neill's Bacon Factory, Salisbury.

6/37. No. 1034. Nyouti or Munga (*Pennisetum typhoides*) as a Feed for Bacon Pigs, by C. A. Murray and A. E. Romyn.

7/37. No. 1036. Preliminary Report on the Feeding of Winter Supplements to young growing steers and the effect of supplementary feeding on the subsequent development of these animals, by C. A. Murray and A. E. Romyn.

12/37. No. 1049. The Export of Frozen Porkers: Report on Five Consignments of Porkers Exported to Smithfield, by Division of Animal Husbandry.

1/38. No. 1053. The Feeding of Sunnhemp Hay as compared with Cow pea Hay in the Fattening Ration for Bullocks, by A. E. Romyn and R. H. Fitt

2/38. No. 1058. Pig Industry Act, 1937. Division of Animal Husbandry.

9/38. No. 1083. Internal Parasites in Sheep, by Percy D. Huston, M.R.C.V.S., District Veterinary Officer.

11/38. No. 1091. Cost of Fattening Bullocks of various ages in Matabeleland, by A. E. Romyn and C. A. Murray.

6/39 No. 1115. Feeding Young Stock in Winter, by C. A. Murray, M.Sc (Agr.) and A. E. Romyn, Ph.D., Division of Animal Husbandry, Department of Agriculture, Southern Rhodesia.

7/39. No. 1120. Urea as a possible substitute for Peanut Cake for Wintering Young Stock, by C. A. Murray and A. E. Romyn.

8/39. No. 1124. Cattle Bale or Grip.

1/40. No. 1140. The Summer Fattening of Bullocks, by the Division of Animal Husbandry

2/40. No. 1143. Larger Calf Crops will increase your Profits, by C. A. Murray, Senior Animal Husbandry Officer in Charge, Government Experiment Station, Matopos.

3/40. No. 1147. A Home-made Cow Stanchion, by Major R. R. Sharp, Whinburn, Redbank.

7/41. No. 1175. The Raising of Bacon Pigs, by A. E. Romyn, Chief Animal Husbandry Officer, and C. A. Murray, Senior Animal Husbandry Officer in Charge, Rhodes Matopo Estate, with a Veterinary Section by D. A. Lawrence, Director of Veterinary Research.

1/42. No. 1192. The Production of "Rhodesia Best" Beef, by A. E. Romyn, Chairman, Pasture Research Committee

1/42. No. 1193. Costs of Fattening "Rhodesia's Best" Steers, and the Importance of Compost as an Item of Profit on the Witchweed Demonstration Farm, by S. D Timson, M.C., Asst. Agriculturist; and G L Black, Dip Agric. (Durham), Manager.

DAIRYING.

12/30. No. 799 The Objects of Ripening Cream for Butter-making, and a few Hints on Cream Production, by F. Lammas, Dairy Officer.

9/32. No. 862. Cream Cheese, by F. A. Lammas, Dairy Officer.

3/33. No. 880. Dairy Tests and Calculations, by F. A. Lammas, Dairy Officer.

5/34. No. 922 Dairy Building in Southern Rhodesia: A Small Farm Dairy, by G. B. Gundry, A I.Mech E.

7/34. No. 926. Dairy Buildings in Southern Rhodesia. Cow Byre—Type II., by B. G. Gundry, A.I.Mech.E.

12/34. No 937. Gouda or Sweet Milk Cheese, by F. Lammas, District Dairy Officer.

2/36. No. 977. Notes on the Feeding of Dairy Cows during the Summer Months, by A. E. Romyn, Chief Animal Husbandry Officer

6/36. No. 990. Southern Rhodesia Milk Recording Scheme.

12/37. No. 1051. The Production and Handling of Milk and Cream, by the Dairy Branch.

12/38. No. 1094. Farm Butter Making, by The Dairy Branch.

1/41. No. 1170. The Manufacture of Cheddar Cheese, by The Dairy Branch.

VETERINARY.

12/25.	No. 570.	The Spaying of Bovines, by G. C. Hooper Sharpe, M.C., M.R.C.V.S., and M. H. Kingcombe, M.R.C.V.S.
6/26.	No. 597.	Suspected Poisoning of Stock: The Proper Procedure, by M. H. Kingcombe, M.R.C.V.S. (Lond.), and A. W. Facer, B.A. (Oxon.), A.I.C.
12/26.	No. 618.	Notes from the Veterinary Laboratory: Quarter Evil, by Ll. E. W. Bevan, M.R.C.V.S., Director of Veterinary Research.
1/28.	No. 666.	Notes from the Veterinary Laboratory: Praemonitus—Praemunitus, by Ll. E. W. Bevan, M.R.C.V.S., Director of Veterinary Research.
10/29.	No. 756.	Parasitic Gastritis of Cattle, by Ll. E. W. Bevan, M.R.C.V.S., Director of Veterinary Research.
11/29.	No. 760.	A Note on Sheep Diseases in Southern Rhodesia, by D. A. Lawrence, B.V.Sc., Veterinary Research Officer, Department of Agriculture, Salisbury.
2/30.	No 772.	Notes from the Veterinary Laboratory: Ophthalmia, by Ll. E. W. Bevan, M.R.C.V.S., Director of Veterinary Research.
4/31.	No. 819.	Measles in Swine, by P. D. Huston, M.R.C.V.S.
1/32.	No. 841.	Poisonous or Suspected Poisonous Plants of Southern Rhodesia: Tulip Poisoning of Cattle, by Sydney M. Stent, Senior Botanist, and D. A. Lawrence, B V.Sc., Veterinary Research Officer.
10/32.	No. 866.	The Treatment of Intestinal Parasites of Sheep, by J. D. Coutts, D.V.S., M.R C.V.S.
4/33.	No. 886	A Preliminary Note on Contagious Granular Vaginitis in Southern Rhodesia, by D. A. Lawrence, B V.Sc, Acting Director Veterinary Research
2/40.	No. 1142.	Low Birth-rate of Calves and Calf Mortality, by B. A. Myhill, M.R.C.V.S., Chief Veterinary Surgeon.
8/41.	No. 1179.	Trypanosomiasis or Tsetse Fly Disease, by D. A. Lawrence, B.V.Sc., Director of Veterinary Research.
12/41.	No. 1191.	Laboratory Diagnosis of Disease: Preparation of Smears, by J. M. Williamson, B.Sc., M.R.C.V.S., Veterinary Research Department.
8/42.	No. 1207.	The Construction of Dipping Tanks, by B. G. Gundry, A.I.Mech.E.; and Notes on their Management, by J. M. Sinclair, M R.C.V.S., Chief Veterinary Surgeon.
8/42.	No. 1209.	Sweating Sickness, by D. A. Lawrence, B.V.Sc., Director of Veterinary Research.

IRRIGATION, WATER SUPPLIES AND SOIL EROSION.

4/27.	No. 640.	Levelling for Irrigation, by Dr. W. S. H. Cleghorn, M.I.Mech.E.
11/27.	No. 659.	The Hydraulic Ram, revised by P. H. Haviland, B.Sc.
11/28.	No. 668.	The Water Act, 1927, by C. L. Robertson, B.Sc. (Eng.), A.M.I.C.E.
1/28.	No 670.	Irrigation Canals, by P. H. Haviland, B.Sc. (Eng.).
6/30.	No. 786.	Low Concrete Dams, by R. Hamilton Roberts, B.Sc. (Eng.), Assistant Irrigation Engineer.
2/31.	No. 808.	The Application of Water in Irrigation, by R. Hamilton Roberts, B.Sc. (Eng.), Assistant Irrigation Engineer
3/31.	No 811.	Irrigation Canal Structures, by R. H. Roberts, B.Sc. (Eng.), Assistant Irrigation Engineer.
8/32.	No. 860.	Soil Drainage and Utilisation of Vleis, by R. H. Roberts, B.Sc. (Eng.), Assistant Irrigation Engineer.
2/33.	No 879.	Conditions Governing the Hire of Government Boring Machines.
6/35.	No 956.	Annual Report of the Division of Irrigation for the year ended 31st December, 1934, by P. H. Haviland, B.Sc. (Eng.), Acting Chief Irrigation Engineer.

9/35.	No. 967.	How to use an Engineer's or Farm Level, by P. H. Haviland, B.Sc. (Eng.), A.M.I.C.E., Irrigation Engineer (Matabeleland).
12/35.	No 973.	Domestic Water Supplies and Sanitation on the Farm, by P. H. Haviland, B.Sc. (Eng.), A.M.I.C.E.. Irrigation Engineer (Matabeleland).
3/36.	No. 980.	Results from Glenara Soil Conservation Experiment Station, 1934-35 Season, by C. L. Robertson, B.Sc. A.M.I.C.E., Chief Engineer, Irrigation Division, and A. D. Husband, F.I.C., Chief Chemist.
8/36.	No. 999.	Lining an Irrigation Furrow, by R. H. Roberts, B.S.. A.M.Inst.C.E., Assistant Irrigation Engineer.
1/38.	No. 1052	Small Earthen Storage Dams. Part I. By the Irrigation Division.
2/38.	No. 1055.	Small Earthen Storage Dams. Part II. By the Irrigation Division.
3/38.	No. 1061.	Soil Drainage and Utilisation of Vleis, by R. H. Roberts, B.Sc. (Eng.), Assistant Irrigation Engineer.
7/38.	No. 1077.	A Small Brick Irrigation Furrow, by H. W. H. Wallis, Assistant Irrigation Engineer.
11/38.	No. 1088.	How to Instal a Simple and Efficient Hot Water Supply on a Farm, by W. A. Welch, Tantallon Farm, Salisbury.
1/39.	No. 1095.	Soil and Water Conservation, by D. Aylen, for the Irrigation Division.
9/39.	No. 1127.	Soil and Water Conservation. Part III. By D. Aylen and the Irrigation Officers.
11/39.	No. 1130.	The Conditions Governing the Hire of Government Boring Machines, by Major C. E. Goad, M.C., Boring Superintendent.
2/40.	No. 1141.	Government Loans and Subsidies, etc., for soil and water conservation, green manuring and artificial fertilisers.
3/40.	No. 1144.	The Ridger Grader, by D. Aylen and the Irrigation Department.
4/40.	No. 1148.	Contour Planting and Terracing of Orchards, by D. Aylen and the Irrigation Department.
5/40.	No. 1151.	Working Loam Soils for High Yields, by D. Aylen.
6/40.	No. 1155.	Soil and Water Conservation. Part IV. Prevention and Control of Gullies, by D. Aylen and the Irrigation Officers.
10/40.	No. 1163.	The Conditions Governing the Hire of Government Boring Machines, by Major C. E. Goad, M.C., Boring Superintendent
4/41.	No. 1171.	Erosion and Malaria: Measures which Control both Evils, by G. R. Ross, Director of Public Health Laboratories, and D. Aylen, Technical Assistant for Soil Conservation.
4/41.	No. 1171.	Erosion and Malaria: Measures which Control both Evils, by G. R. Ross. Director of the Public Health Laboratories, and D. Aylen, Technical Assistant for Soil Conservation.

FORESTRY.

11/29.	No 763.	The Utilisation of Wood. by T. L. Wilkinson, M.Sc., B.Sc.F.
1/30.	No. 769.	The Utilisation of Wood, by T. L. Wilkinson, M.Sc., B.Sc.F.
4/30.	No. 778.	The Utilisation of Wood in Southern Rhodesia—Conversion and Disposal of Timber, by T. L. Wilkinson, M.Sc., B.Sc.F., District Forest Officer
8/30.	No. 791.	The Utilisation of Wood in Southern Rhodesia: Fencing, by T. L. Wilkinson, M.Sc., B.Sc.F., District Forest Officer.
7/32.	No. 857.	Charcoal Burning on the Farm, by R. J. Allen, Forester, Rhodes Matopo School of Agriculture and Experiment Station.

11/32. No 869. Wind-breaks and Shelter Belts, by A. A. Pardy, B.Sc., Forestry.

1/33. No. 874. Tree Planting, by the Division of Forestry.

4/33. No. 888. The Vegetable Ivory Palm (Hyphoene ventricosa), by G. M. McGregor, B.Sc., District Forest Officer, Matabeleland.

8/34. No. 928. Some Trees, Shrubs, Shrubby-Herbaceous Plants, Climbers and Water Plants suitable for the Colony, by J. W. Barnes, Manager, Government Forest Nursery, Salisbury.

12/35. No. 974. Summary of the Annual Report of the Division of Forestry for the year 1934, by E. J. Kelly-Edwards, M.A., Dip. For. (Oxon.), Chief Forest Officer.
Price List of Forest-tree Transplants, Ornamental Trees Shrubs, Hedge Plants, Creepers and Seeds obtainable at the Government Forest Nursery, Salisbury.

10/37. No. 1045. Seventeenth Annual Report of the Division of Forestry for the Year 1936, by E. J. Kelly Edwards, M.A., Dip. For. (Oxon.), Conservator of Forests.

6/38. No. 1073. Pruning of Plantations, by R. H. Finlay, B.A., Oxon., Division of Forestry.

7/38. No. 1076. Eighteenth Annual Report of the Division of Forestry for the year 1937, by E. J. Kelly Edwards, M.A., Dip. For. (Oxon.), Conservator of Forests.

10/38. No. 1085. The Pot Planting of Eucalypts, by Major G. R. Wake, Vigila, Umvukwes.

11/38. No. 1087. The Raising and Planting of Trees on the Farm, by E. J. Kelly Edwards, M A., Dip. For. (Oxon), Conservator of Forests.

1/40. No. 1138. Nineteenth Annual Report Division of Forestry for the year 1938, by E. J. Kelly Edwards, M.A., Dip. For. (Oxon.), Conservator of Forests.

8/40. No. 1159. Timber Preservation: Butt Treatment. by R. H. Finlay, District Forest Officer.

8/41 No. 1178. The Raising and Planting of Trees on the Farm, by E. J. Kelly Edwards, M.A., Dip. For. (Oxon.), Conservator of Forests.

12/41. No. 1190. Pitsawing, by E. J. Kelly Edwards, M A , Dip For. (Oxon.), Conservator of Forests.

HORTICULTURE

4/27. No 637. Harvesting, Packing and Marketing of Deciduous and Tropical Fruits, by G. W. Marshall, Horticulturist.

8/27. No. 650. Coffee Culture in Southern Rhodesia, by G. W. Marshall, Horticulturist.

2/29. No 725. Investigations into "Collar-Rot" Disease of Citrus, by J. C. F. Hopkins, B.Sc. (Lond), A.I.C.T.A. (Trinidad)

11/31. No. 834. Celery Culture, by G. W. Marshall, Horticulturist.

2/33. No. 876. Notes on African Aloes (Parts 1-6), by H. Basil Christian, "Ewanrigg," Arcturus.

10/33. No 905. Notes on African Aloes (Parts 7-10), by H. Basil Christian, "Ewanrigg," Arcturus.

5/34. No. 920 Citrus Fruit Growing in Rhodesia, by G W. Marshall, Horticulturist.

5/37. No. 1028. Tomato Culture in Southern Rhodesia, by G. W. Marshall, Horticulturist.

2/38. No. 1056. Notes on the Cashew Nut. By C. K. Brain, Director of Agriculture.

2/39. No. 1100. The Rhodesian Home Orchard, by G. W. Marshall, Horticulturist.

4/40. No. 1150. The Health of Seed Potatoes, degeneration due to virus diseases is the greatest source of loss. Journal of the Ministry of Agriculture, December, 1939.

5/42. No. 1201. Vegetable Growing in Southern Rhodesia, by G. W. Marshall, Horticulturist. Control of Diseases and Pests: How to Prevent Waste, by Dr. J. C. F. Hopkins, Senior Plant Pathologist, and Alexander Cuthbertson, Entomologist.

ENTOMOLOGY AND PLANT PATHOLOGY.

2/13.	No.	139.	Termites, or "White Ants," by Rupert W. Jack, F.E.S
6/15.	No.	214.	Some Household Insects, by R. Lowe Thompson, B.A.
2/21.	No	385.	The Common Fruit Beetle, by R. W. Jack, F.E.S.
12/24	No.	522	Notes on the Black Citrus Aphis, by C. B. Symes.
8/25.	No.	548.	Insect Pests of Cotton, by C. B. Symes.
9/27.	No.	653.	The Care of Tobacco Seed Beds, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A. (Trinidad).
1/28.	No.	665.	Tobacco Pests of Rhodesia, by Rupert W. Jack, F.E.S., Chief Entomologist.
2/28.	No.	671.	Wildfire and Angular Spot of Tobacco, by J. C. F. Hopkins, B.Sc., A.I.C.T.A.
6/28.	No.	696.	Ticks Infesting Domestic Animals in Southern Rhodesia, by Rupert W. Jack, F.E.S., Chief Entomologist.
11/28.	No.	714.	Trap Cropping against Maize Pests, by Rupert W. Jack, F.E.S., Chief Entomologist.
3/29.	No.	732.	Two Common Diseases of Potato Tubers in Rhodesia, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A.
6/29	No	742.	What is Diplodia in Maize? An Answer to a Popular Question To-day, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Chief Botanist and Mycologist.
9/29.	No.	754.	"Pinking" of Maize: Report of a Preliminary Investigation, by T. K. Sansom, B.Sc., Plant Breeder.
6/30.	No.	784.	Field Control of Frenching in Tobacco, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Plant Pathologist.
6/30	No.	788.	A List of Plant Diseases Occurring in Southern Rhodesia, by J. C. F. Hopkins, B.Sc. (Lond), A.I.C.T A., Plant Pathologist.
			A List of Plant Diseases Occurring in Southern Rhodesia, by J. C. F. Hopkins, B.Sc. (Lond), A.I.C.T.A., Plant Pathologist. Supplement No. 1.
7/30.	No	790.	Notes on the Control of Some of the More Important Insect Pests of Citrus in Southern Rhodesia, by W. J. Hall, Ph.D., B.Sc., Entomologist to the British South Africa Company in Southern Rhodesia.
10/30.	No	796.	The Army Worm (Laphygma exempta, Wlk.), by Rupert W. Jack, Chief Entomologist.
11/30.	No.	798.	The Preparation of Bordeaux Mixture and Seasonal Notes on Tobacco Diseases, by J. C. F. Hopkins, B.Sc. (Lond.), A.I C T.A.
1/31	No.	804.	Locusts in Southern Rhodesia, by Rupert W. Jack, Chief Entomologist.
3/32.	No	848	Mycological Notes: Seasonal Notes on Tobacco Diseases: 3, Frog Eye; 4, White Mould; by J. C. F. Hopkins, B Sc. (Lond.).
4/32.	No.	850.	Pests of Stored Tobacco in Southern Rhodesia, by M. C Mossop, M.Sc., Entomologist.
6/32.	No.	856.	A List of Plant Diseases occurring in Southern Rhodesia, Supplement 2, by J. C. F. Hopkins, B.Sc. (Lond.), Government Plant Pathologist.
9/32	No.	861.	Further Notes on Leaf Curl of Tobacco in Southern Rhodesia, by J. C. F. Hopkins, B.Sc. (Lond.), Plant Pathologist.
5/33	No.	892.	The Tsetse Fly Problem in Southern Rhodesia, by R. W. Jack, Chief Entomologist.
5/33.	No.	893	Experiments with Tsetse Fly Traps against Glossina Morsitans in Southern Rhodesia, by R. W. Jack, Chief Entomologist.
6/33	No	894.	Mycological Notes. Seasonal Notes on Tobacco Diseases. 6 An Unusual Type of Frog Eye Spotting, by J. C. F. Hopkins, B.Sc. (Lond.). A.I.C.T.A., Government Plant Pathologist.
6/33.	No.	896.	A List of Plant Diseases occuring in Southern Rhodesia. Supplement 3. (New Records for period June, 1932, to May, 1933.) Compiled by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Government Plant Pathologist.

7/33. No. 897. The Report of the Chief Entomologist for the year ending 31st December, 1932, by Rupert W. Jack, F.E.S., Chief Entomologist.

8/33. No. 899. The Black Maize Beetle (Heteronchus Licus Klug), by C. B. Symes.

2/34. No. 911. Screw Worm. A Pest of Ranch Cattle in Southern Rhodesia, by A. Cuthbertson, Entomologist. Foreword by R. W. Jack, Chief Entomologist.

3/34. No. 913. Locusts: Instructions for dealing with Flying Swarms, by The Division of Entomology.

4/34. No. 917. The Life History of the Screw-worm Fly, by Alexander Cuthbertson, Entomologist.

10/34. No 934. Mycological Notes. Seasonal Notes on Tobacco Diseases. 7, Spraying in Seed-beds and Lands, by J. C. F. Hopkins, D.Sc. (Lond.), A.I.C.T.A., Senior Plant Pathologist.

1/35. No. 942 Mycological Notes. Seasonal Notes on Tobacco Diseases. 8, The Mosaic Mystery. 9, Danger Points in Field Spraying, by J. C. F. Hopkins, D.Sc. (Lond.), A.I.C T.A., Senior Plant Pathologist.

4/35. No. 950. The Control of Tsetse Fly in Southern Rhodesia, by Rupert W. Jack, Chief Entomologist.

4/35. No 951. Suspected "Streak" Disease of Maize. Notice to Growers, by J. C. F. Hopkins, D.Sc. (Lond.), A I.C.T.A., Senior Plant Pathologist.

6/35. No. 957. Annual Report of the Branch of Plant Pathology for the year ending 31st December, 1934, by J. C. F. Hopkins, D.Sc. (Lond.), A.I.C.T.A., Senior Plant Pathologist.

8/35. No. 962. The Report of the Chief Entomologist for Year ending 31st December, 1934, by R. W. Jack, Chief Entomologist.

10/35. No 969 The Objects and Value of Seed Treatment of Maize against Diplodia, by G. M. Wickens, Ph.D. (Lond.), D.I.C., Assistant Plant Pathologist.

5/36. No 986 Annual Report of the Division of Entomology for year ending 31st December, 1135, by Rupert W. Jack, Chief Entomologist

7/37. No. 1037. Division of Entomology: Annual Report for year 1936, by R. W. Jack, Chief Entomologist.

8/37. No. 1040. A Programme for the Control of Diseases of Apple Trees in Southern Rhodesia, by J. C. F. Hopkins, D.Sc (Lond.), A.I.C.T.A., Senior Plant Pathologist.

10/37. No. 1047. Mycological Notes: Seasonal Notes on Tobacco Diseases. X.: Precautionary Methods in Seed-beds, by J. C. F. Hopkins, D.Sc. (Lond.), A.I.C.T.A., Senior Plant Pathologist.

12/37. No. 1050. An Unusual Winter Outbreak of Maize Weevil *Calandra oryzae*, L.), by M. C. Mossop, M.Sc., Entomologist, Department of Agriculture.

2/38. No. 1059. A Poison Bait for Young Locust Hoppers.

2/38. No. 1060. How to make Tobacco-Wash on the Farm, by M. C. Mossop, M.Sc., Entomologist, Department of Agriculture.

6/38. No. 1074. A Note on a Stem Rot of Sweet Peas, by J. C. F. Hopkins, D.Sc., A.I.C.T.A., Senior Plant Pathologist

7/38. No. 1078 Mycological Notes: Seasonal Notes on Tobacco Diseases II. Two Destructive Curing Moulds, by J. C. F Hopkins, D.Sc. (Lond.), A.I.C.T.A., Senior Plant Pathologist.

8/38. No. 1079. Annual Report of the Branch of Plant Pathology for the year ending 31st December, 1937, by J. C. F. Hopkins, D.Sc. (Lond.), A.I.C.T.A., Senior Plant Pathologist

8/38. No. 1080. Annual Report of the Division of Entomology for the year ended 31st December, 1937, by Rupert W. Jack, Chief Entomologist.

9/38. No. 1082. The *Life* History of Root Gallworm or Root Knot Eelworm, by M. C. Mossop, M.Sc., Entomologist.

10/38. No. 1086. The Spraying of Tobacco Seed-beds and Control of Rosette Disease, by J. C. F. Hopkins, D.Sc. (Lond.), A.I.C.T.A., Senior Plant Pathologist, and M. C. Mossop, M.Sc., Entomologist.

1/39. No. 1097. Cleanliness Aids Insect Control: Some Examples of Agricultural Hygiene, by M. C. Mossop, M.Sc., Entomologist.

4/39. No. 1108. Three Important Strawberry Diseases, by J. C. F. Hopkins, D.Sc. (Lond.), A.I.C.T.A., Senior Plant Pathologist.

8/39. No. 1121. Report of the Division of Entomology for the year ending 31st December, 1938, by J. K. Chorley, Acting Chief Entomologist.

8/39. No. 1122. Report of the Branch of Plant Pathology for the year ending 31st December, 1938, by J. C. F. Hopkins, D.Sc. (Lond.), A.I.C.T.A., Senior Plant Pathologist.

10/39. No. 1128. Mycological Notes. 12. The Diplodia Danger, by J. C. F. Hopkins, D.Sc., A.I.C.T.A., Senior Plant Pathologist.

11/39. No. 1132. Mycological Notes. 13. The Diplodia Danger, by J. C. F. Hopkins, D.Sc., A.I.C.T.A., Senior Plant Pathologist.

12/39. No. 1134. Mycological Notes. 14. Seasonal Notes on Plant Diseases, by J. C. F. Hopkins, D.Sc. (Lond.), A.I.C.T.A., Senior Plant Pathologist.

3/40. No. 1145. The Bed Bug and a new aid for its control, with special reference to native quarters, by M. C. Mossop, M.Sc., Entomologist.

5/40. No. 1152. Diseases of Fruit, Flowers and Vegetables in Southern Rhodesia. I.—Common Diseases of Apples and their Control, by J. C. F. Hopkins, D.Sc. (Lond.), A.I.C.T.A., and Aline L. Bacon, B.Sc., Division of Plant Pathology.

6/40. No. 1156. Mycological Notes. 15—The Tobacco "Kromnek" Virus in Rhodesia, by J. C. F. Hopkins, D.Sc. (Lond.), A.I.C.T.A., Senior Plant Pathologist.

9/40. No. 1161. Control of Maize Weevil (Calandra oryzae, L.), by M. C. Mossop, A.F.C., M.Sc., Entomologist.

9/40. No. 1162. Diseases of Fruit, Flowers and Vegetables in Southern Rhodesia. 2.—Black Rot Disease of Cabbages and Cauliflowers, by J. C. F. Hopkins, D.Sc. (Lond.), A.I.C.T.A., Senior Plant Pathologist.

7/41. No. 1177. Tsetse Fly Operations: Short Survey of the Operations by Districts, by J. K. Chorley, Entomologist. Extracted from the Annual Report of the Chief Entomologist.

8/41. No. 1180. Diseases of Fruit, Flowers and Vegetables in Southern Rhodesia: 3. Common Diseases of Snapdragons, by J. C. F. Hopkins, D.Sc. (Lond.). A.I.C.T.A., Senior Plant Pathologist.

10/41. No. 1184. Cultural Measures for Control of Root-Knot Eelworm, with Special Reference to Tobacco, by R. W. Jack, Chief Entomologist.

12/41. No. 1188. Diseases of Fruit, Flowers and Vegetables in Southern Rhodesia: 5, Diseases of Potatoes, by J. C. F. Hopkins, D.Sc. (Lond.), A.I.C.T.A., Senior Plant Pathologist.

5/42. No. 1201. The Skin Maggot Fly, by Alexander Cuthbertson, F.R.E.S., Entomologist.

3-5/42. No. 1205. Ticks Infesting Domestic Animals in Southern Rhodesia, by Rupert W. Jack, Chief Entomologist.

8/42. No. 1208. Tsetse Fly Operations: Short Survey of the Operations by Districts, for the year ending December, 1941, by J. K. Chorley, Entomologist.

POULTRY.

3/27.	No.	635.	Ovarian Troubles, by A. Little, Poultry Expert.
1/29.	No.	721.	Poultry Keeping in Rhodesia: Pedigree Breeding, by H. G. Wheeldon, Poultry Expert.
1/31.	No.	803.	Geese, by G. H. Cooper, Assistant Poultry Officer.
9/31.	No.	827.	The Ideal Brooder, by F. Roberts, Assistant Poultry Officer.
10/32.	No.	865.	Poultry Industry: Care of Young Stock in Hot Weather, by H. G. Wheeldon, Poultry Expert.
11/32.	No.	870.	Trap Nests, by B. G. Gundry, A.I.Mech.E. (combined with No. 875).
12/32.	No.	872.	The Rearing and Fattening of Table Poultry, by H. G. Wheeldon, Poultry Expert.
3/33.	No.	884.	The Vitamins in Poultry Feeding, by G. H. Cooper, Assistant Poultry Officer.
5/34.	No.	918.	The Moulting of Poultry: The Normal and Pullet Moult, by H. G. Wheeldon, Poultry Expert.
3/34.	No.	947.	Modern Culling of Laying Hens, by G. H. Cooper, Assistant Poultry Officer.
9/35.	No.	966.	Egg Marketing Bill: Draft of a Bill having for its purpose the more orderly Marketing of Eggs.
11/38.	No.	1090.	A Cheap Portable Colony House for Poultry, by G. H. Cooper, Assistant Poultry Officer.
12/38.	No.	1092.	Feeding and Drinking Appliances for Poultry, by G. H. Cooper, Assistant Poultry Officer.
5/39.	No.	1111.	Ducks on the Farm, by H G. Wheeldon, Poultry Expert.
12/39.	No.	1135.	Feeds for Poultry and How to Use Them, by G. H. Cooper, Assistant Poultry Officer.
5/41.	No.	1172.	Housing and Feeding of Adult Stock, by H. G. Wheeldon Poultry Expert.
9/41.	No.	1182.	The Artificial Incubation, Brooding and Rearing of Chickens, by H. G. Wheeldon, Poultry Expert.
11/41.	No.	1186.	Sex-Linkage in the Pure Black Australorp, by G. H. Cooper, Assistant Poultry Officer.
12/41.	No	1189.	Substitute Rations: Plan ahead for Poultry Feeding Problems, by H G Wheeldon, Poultry Expert

PAMPHLETS.

The following pamphlets can be obtained from the Poultry Officer upon application:—

Abnormalities in Eggs, by A. Little, Poultry Expert.

Close of the Hatching Season and After, by H. G. Wheeldon, Poultry Expert.

Conditions of Birds on Show, by A. Little, Poultry Expert.

Coccidiosis, or Entero Hepatitis.

Diseases of the Digestive System, by A. Little, Poultry Expert.

Diseases of the Liver, by A. Little, Poultry Expert.

Fowl Tick, The (Argas persicus), by A. Little, Poultry Expert.

Grit Shell and Charcoal, by A. Little, Poultry Expert.

Grow Sunflowers, by H. G. Wheeldon, Poultry Expert.

Hints to Breeders: Care of Chicks, by A. Little, Poultry Expert.

Hints to Breeders: Heart Trouble, by A. Little, Poultry Expert.

Hints to Breeders: Vices, by A. Little, Poultry Expert.

Preparing Birds for Show, by A. Little, Poultry Expert.

Prevention of Diseases among Poultry, by A. Little, Poultry Expert.

Respiratory Disease, by A. Little, Poultry Expert.

Selection of Eggs for Incubation, by H. G. Wheeldon, Poultry Expert.

Selection and Preparation of Fowls for Exhibition, by H. G. Wheeldon, Poultry Expert.

METEOROLOGICAL.

12/22. No. 436. The Possibility of Seasonal Forecasting and Prospects for Rainfall Season, 1922-23, by C. L. Robertson, B.Sc., A.M.I.C.E.

12/24. No. 524. The Use of an Aneroid Barometer, by C. L. Robertson, B.Sc., A.M.I.C.E.

2/25. No. 532. The Short Period Forecast and Daily Weather Report, by C. L. Robertson, B.Sc., A.M I.C.E.

6/25. No 542. Review of the Abnormal Rainfall Season, 1924-25, by C. L. Robertson, B.Sc., A.M.I.C E.

10/28. No. 712. The Time, and How to Find It, by N. P. Sellick, M.C., B.Sc. (Eng.).

10/31. No. 832. The Weather Map and the Short Period Weather Forecast, issued by the Meteorological Office.

2/33. No. 877. Clouds and Weather in Southern Rhodesia, by N. P. Sellick, M.C., B.Sc., Meteorologist.

AGRICULTURAL BUILDINGS.

4/26. No. 588. Concrete on the Farm, by N. P. Sellick, M.C., B.Sc. (Eng.), Assistant Irrigation Engineer.

8/26. No. 605. Flue-curing Tobacco Barns. Bulking and Grading Sheds, by P. H Haviland, B Sc. (Eng.), Acting Government Irrigation Engineer.

5/27. No. 644. Tobacco Baling Boxes, by B. G. Gundry, Irrigation Branch.

11/27. No. 661. Flue-curing Tobacco Barns, 12 ft. x 12 ft. x 16ft., by B. G. Gundry.

9/33. No. 902. Brick-making on the Farm, by A. C. Jennings, Assoc.M.Inst.C.E.

12/33. No. 908. A Charcoal Safe or Cooler, by B. G. Gundry, A.I.Mech E., Irrigation Division.

5/34. No. 922. Dairy Building in Southern Rhodesia: A Small Farm Dairy, by B. G. Gundry, A.I.Mech E.

7/34. No 926. Dairy Buildings in Southern Rhodesia. Cow Byre—Type II., by B. G. Gundry, A.I Mech E.

10/36. No 1002. A Simple Farm Gate, contributed by the Division of Forestry.

5/37. No. 1031. Cattle Bale Grip.

8/37. No. 1041. Feeding Pens for Bullocks: the Layout at Estes Park, near Salisbury.

1/39. No. 1098. The "Gundry" Tobacco Furnace, by B. G. Gundry, A.I.Mech.E.

12/40. No. 1169. Piggeries, by B. G. Gundry, A.I.Mech.E., and A. E. Romyn, Ph.D

CHEMISTRY

12/29. No. 762.—The Value of Rock Phosphate and "Bone and Super phosphate" as Fertilisers for Maize Production, by A. D. Husband, Chief Chemist.

4/32. No. 852. Mixing of Fertilisers: A Guide to Methods of Calculation, by the Division of Chemistry.

1/34. No. 910. The Toxicity to Grazing of Grass Sprayed with a Solution of Sodium Arsenite, by A. D. Husband, F.I.C., and J. F Duguid, M.A., B.Sc.

5/35. No. 954. Experiments on the Toxicity to Fowls of Arsenite of Soda and Poisoned Locusts, by J. K. Chorley, F.R.E S., and R. McChlery, B.A., B.Sc.

4/36. No. 983. Annual Report of the Branch of Chemistry for year ending 31st December, 1935, by A. D. Husband, F I.C., Chief Chemist.

7/37. No. 1035. Analyses of Rhodesian Foodstuffs, by The Division of Chemistry.

MISCELLANEOUS.

4/28. No. 686. The Land Bank, Its Functions and How it Operates, by S. Thornton.

4/28. No. 687. The Use of Explosives on the Farm, by P. H. Haviland, B.Sc. (Eng.).

9/28. No. 707. Wood-Charcoal in Southern Rhodesia, by T. L. Wilkinson, B.Sc., Assistant Forest Officer.

5/31. No. 820. The Great Economic Problem in Agriculture—No. 1, by J. R McLoughlin, M.Sc. (Economist), Economic Adviser.

6/31. No 823. The Law of Supply and Demand—No. 2, by J. R McLoughlin, M Sc. (Economics), Economic Adviser.

Twelve Simple Rules for the Avoidance of Malaria and Blackwater.

Summary of the Game Laws of Southern Rhodesia.

11/34. No 935 The Weeds and Poisonous Plants of Southern Rhodesia, by Chas. K. Brain, M.A., D.Sc., Director of Agriculture. Part I.

1/36. No. 975. Fertilizers, Farm Foods, Seeds and Pests Remedies Ordinance, 1914.

2/36. No. 979 The Prospects of Black Bass in the Inland Waters of Southern Rhodesia. Specially contributed

8/36. No. 998 Summary of the Game Laws of Southern Rhodesia.

3/37. No. 1018. Veld Fires. The "Forest and Herbage Preservation Act, 1936," by E. J. Kelly Edwards, M.A., Dip. For. (Oxon.), Chief Forest Officer.

7/37. No. 1038. Star Bur-weed (*Acanthospermum australe*, O. Kuntze), by Chas. K. Brain, D.Sc., Director of Agriculture.

8/37. No. 1042. Weeds of Southern Rhodesia. Part II. By Chas. K Brain, D.Sc., Director of Agriculture.

2/38. No. 1057. The Preservation of Farm Beacons and how to make use of the Fencing Law

3/38. No. 1064. Farm Roads, by Stuart Chandler, Chief Road Engineer

4/38 No. 1065. Nitrification in Red Soil in the Salisbury Area, by A. P Taylor, M.A., B Sc., and B. S. Ellis, B.Sc , A.I C., D.I.C., Agricultural Chemists.

4/38. No. 1068. The Control of Veld Fires, by The Division of Forestry.

9/38. No. 1081. Uncontrolled Grass and Forest Fires and their Prevention, by the Rev. Father A. B. Burbridge, S J.

1/39. No. 1096. Trees and Wild Flowers on the Rhodesian Farm. Part I. By Chas. K. Brain, M.A., D Sc , Director of Agriculture.

2/39. No. 1099. Trees and Wild Flowers on the Rhodesian Farm. Part II. By Chas. K. Brain, M A., D.Sc , Director of Agriculture.

3/39. No. 1102. Trees and Wild Flowers on the Rhodesian Farm Part III. By Chas. K. Brain, M.A., D Sc., Director of Agriculture.

4/39. No. 1103. Scurvy and How to Prevent It. Public Health Pamphlet No. 3.

4/39. No. 1106. Trees and Wild Flowers on the Rhodesian Farm. Part IV. By Chas. K. Brain, M.A., D.Sc., Director of Agriculture.

4/39. No. 1107. Some Notes on Game Bird Preservation, by W. E. Poles, Esq., on behalf of the Wild Life Protection Society of Southern Rhodesia.

5/39. No. 1109. Summary of the Game Laws of Southern Rhodesia, as at 1st May, 1939.

5/39. No. 1112. Trees and Wild Flowers on the Rhodesian Farm. Part V. By Chas. K. Brain, M.A., D.Sc., Director of Agriculture.

6/39. No. 1114. The Rhodes Inyanga Estate.

6/39. No. 1116. Trees and Wild Flowers on the Rhodesian Farm. Part VI. By Chas. K. Brain, M.A., D.Sc., Director of Agriculture.

7/39. No. 1118. Grass Fires and Fire-belt Burning, by J. R. Perrins, P.B.S. Ranch, Fort Rixon.

7/39. No. 1119. Trees and Wild Flowers on the Rhodesian Farm. Part VII., by Chas. K. Brain, M.A., D.Sc., Director of Agriculture.

8/39. No. 1123. Trees and Wild Flowers on the Rhodesian Farm. Part VIII. By Chas. K. Brain, M.A., D.Sc., Director of Agriculture.

9/39. No. 1125. Trees and Wild Flowers on the Rhodesian Farm. Part IX. By Chas. K. Brain, M.A., D.Sc., Director of Agriculture.

9/39. No. 1126. The Course of Prices of Certain Agricultural Products in Salisbury, by the Acting Government Statistician.

12/39. No. 1133. Trees and Wild Flowers on the Rhodesian Farm. Part X. By Chas. K. Brain, M.A., D.Sc., Director of Agriculture.

1/40. No. 1139. Trees and Wild Flowers on the Rhodesian Farm. Part XI. By Chas. K. Brain, M.A., D.Sc., Director of Agriculture.

3/40. No 1146. Trees and Wild Flowers on the Rhodesian Farm. Part XII. By Chas. K. Brain, M.A., D.Sc., Director of Agriculture.

MEMOIRS.

5/39. No. 1. "Studies in the Physiology and Behaviour of *Glossina morsitans*, Westw.," by Rupert W. Jack, Chief Entomologist. Pp. 203 + vii.

12/39. No. 2. "Descriptive List of Plant Disease in Southern Rhodesia (and their Control), by J. C. F. Hopkins, D.Sc Pp. 51. Price 1/-.

8/41. No. 3. "Further Studies in the Physiology and Behaviour of *Glossina morsitans*, Westw.," by Rupert W. Jack, Chief Entomologist. Pp. 56

Southern Rhodesia Veterinary Report.

APRIL, 1912.

Diseases. Anthrax was diagnosed on the farm Retreat in the Bulalima-Mangwe district.

Tuberculin Test.—Four bulls and ten heifers were tested on importation. There were no re-actors.

Mallein Test.—Twenty-five horses, 31 mules and 22 donkeys were tested with negative results.

IMPORTATIONS.

Union of South Africa.—Bulls 4, cows 10, horses 16, mules 30, sheep 314.

Bechuanaland Protectorate. Sheep and goats, 425.

EXPORTATIONS

Union of South Africa.—Horse 1.

Northern Rhodesia. Bull 1, horses 2, mules 4, sheep 126.

Belgian Congo.—Horses 6, donkeys 22.

Portuguese East Africa.—Bull 1, oxen 120, pig 1.

EXPORTATIONS—MISCELLANEOUS.

In Cold Storage

United Kingdom.—Beef quarters 5,015, boneless beef quarters 2,513, veal carcases 475, tongues 25,889 lbs., livers 25,588 lbs., hearts 13,276 lbs., tails 7,575 lbs., fillets 3,753 lbs., skirts 6,592 lbs., shanks 9,220 lbs.

Northern Rhodesia.—Beef carcases 429, mutton carcases 107, pork carcases 57, veal carcases 4.

Belgian Congo.—Beef carcases 251, mutton carcases 14, veal carcases 6.

Meat Products from Liebigs (Rhodesia) Ltd. Factory, West Nicholson.

Union of South Africa.—Corned beef 285,660 lbs.

Northern Rhodesia.—Corned beef 151,000 lbs.

B. A. MYHILL,
Chief Veterinary Surgeon.

MAY, 1942.

Diseases.—Anthrax was diagnosed on the farms Oatlands and Tokwe Block, Victoria native district.

Tuberculin Test.—Fifteen bulls and 126 cows, heifers and calves were tested on importation. There were no reactors.

Mallein Test.—Four horses were tested on importation with negative results.

Union of South Africa.—Bulls 15, cows, heifers and calves 131, horses 4, sheep 400.

Bechuanaland Protectorate.—Slaughter cattle 175, sheep and goats 696.

EXPORTATIONS.

Northern Rhodesia.—Bulls 24, cows 7, horses 4, sheep 506.

Belgian Congo.—Cows and calves 17, horses 3, donkeys 21.

Portuguese East Africa.—Bulls 2, cows 150, slaughter cattle 118, goats 84.

EXPORTATIONS—MISCELLANEOUS.

In Cold Storage.

United Kingdom.—Beef quarters 2,872, boneless beef quarters 913, veal carcases 189, hearts 966 lbs., skirts 3,252 lbs., shanks 1,648 lbs.

Northern Rhodesia.—Beef carcases 472, mutton carcases 100, pork carcases 42, veal carcases 5, offal 13,523 lbs.

Belgian Congo.—Beef carcases 363, mutton carcases 46, veal carcases 10, offal 1,889 lbs.

Meat Products from Liebigs (Rhodesia) Ltd. Factory, West Nicholson.

Union of South Africa.—Corned beef 301,148 lbs., assorted sausages 224 lbs., assorted lunch rolls 5,032 lbs., meat extract 11,142 lbs.

Northern Rhodesia.—Beef fat 2,100 lbs., assorted sausages 4,128 lbs., assorted lunch rolls 8,256 lbs.

B. A. MYHILL,
Chief Veterinary Surgeon.

SOUTHERN RHODESIA
Locust Invasion, 1932-42.

Monthly Report No. 112. April, 1942.

Flying swarms of the Red Locust (*Nomadacris septemfasciata*, Serv.) were reported during the month from the following districts:—Darwin, Mrewa, Mazoe, Lomagundi, Salisbury, Marandellas and Chibi. The general direction of flight was south to south-west. Some damage to early wheat and other green crops was reported.

A few hopper swarms were reported from the Victoria district early in the month.

J. K. CHORLEY,
Acting Chief Entomologist.

Monthly Report No. 114. May, 1942.

Flying swarms of the Red Locust (*Nomadacris septemfasciata*, Serv.) were reported from the following districts during the month:- Lomagundi (Sinoia, Banket, Sipolilo), Mrewa, Mazoe, Marandellas, Inyanga, Salisbury and Chibi.

In the majority of cases the general direction of flight was south to south-west. Most of the swarms were described as "large" or "very large."

Some damage to wheat was reported.

J. K. CHORLEY,
Acting Chief Entomologist.

Monthly Report No. 115. June, 1942.

Flying swarms of the Red Locust (*Nomadacris septemfasciata*, Serv.) were reported from the following districts during June:—Salisbury, Lomagundi (Sinoia, Chirundu and Darwendale), Sebungwe, Mtoko, Umtali and Enkeldoorn.

Three large swarms invaded the Umtali district from Portuguese East Africa. The general direction of flight was from N.E. to S.W.

Little damage to crops was reported.

J. K. CHORLEY,
Acting Chief Entomologist.

THE RHODESIA
Agricultural Journal

Vol. XXXIX.] No. 5 [September - October, 1942

Editorial

Notes and Comments

Oyster Nuts.

An interesting account of a "Trial Planting of Oyster Nuts" in the Mid-Melsetter district with a photograph of the mature fruit will be found elsewhere in this Journal. The notes were received from Mr. S. M. Sinclair, Albany, Melsetter.

The botanical name of Oyster Nut is *Telfairea pedata* of the family Cucurbitaceae. According to L. H. Bailey, in "The Standard Cyclopedia of Horticulture," Vol. III., the female flowers are five-lobed, approximately 4 inches in diameter, of a brownish-purple colour with a green throat. The male flowers are also five-lobed but only about half the size of the female flowers, of a purple colour with a green star in the centre. The fruit is a gourd and takes about four months to mature. When ripe it varies from 1½ to 3 feet long by approximately 8 inches wide. It is green, oblong in shape and deeply furrowed. When the gourd ripens it begins to crack open, revealing several rows of nuts inside, which are embedded in a salty tasting pulpy mass. The seeds are roundish, about an inch in diameter, and the kernels are very rich in oil—this oil, if properly extracted, is edible. The nuts are soaked to remove the bitterness and are then sundried. The nuts are boiled and eaten by the natives in East Africa.

Historical Dip Tank.

A most interesting letter has been received by the Department of Agriculture from Mr. John Norris, of Devonshire Farm, Umtali, to the effect that the dipping tank at "Placefell" is one of the first six tanks built in South Africa and was paid for by the late Mr. Alfred Beit.

Enquiries regarding the above show that the dipping tank now in use on "Placefell" is the original one built during Mr. Norris' residence. "Placefell" is one of the farms comprising the Rhodes Inyanga Estate and is leased by Captain Ratsey.

Production of Vegetable Seeds.

The following are brief notes extracted from an article entitled "The Production of Vegetable Seeds," by H. van Elden, of the Department of Agriculture and Forestry, appearing in the July, 1942, issue of *Farming in South Africa*.

The writer first deals with the seed position generally in South Africa. He mentions the advantages of sowing in drills rather than broadcast sowing, one advantage being a greater economy in the use of seed. Reference is made to the viability of various seeds. For example parsley and parsnip retain their viability for only one year, onions and leeks for two years, beans, carrots, maize, peas and spinach for three years, beet, cabbage, cauliflower, pumpkin, tomato and turnip for four years, and cucumber, egg plant and lettuce for five years.

The old belief that fresh stocks of vegetable seeds had to be imported every year from abroad is losing ground, as certain lines of vegetable seeds are being just as successfully produced in South Africa by reliable seed growers specialising in the culture of a particular kind or variety of vegetable seed.

Growers are advised to confine themselves to the production of one or only a few kinds of vegetable seeds to which conditions are suited, and to which they can give their attention.

He advises that sowing or planting should be carried out in new clean land and diseases and pests rigorously controlled, and as seed producers, those plants showing desirable characteristics as to yield, vigour, quality, trueness to type and resistance to disease should be selected.

On a large scale the plantings should be gone through at least twice, when the vegetable is in prime condition for consumption and again just before harvesting. All undesirable plants should be removed. This is very important.

Cross-pollination is dealt with. Plantings of easily cross-pollinated or naturally cross-pollinated vegetable types must be widely separated or plantings could be made at different dates so that the times of flowering do not coincide.

Finally valuable information is given regarding selection and collection of seed of the commoner vegetables.

A Simple Treatment for Preserving Sacks.

In these days when every available sack is urgently required the following useful method of preserving sacks is well worth a trial. The method is described by Dr. C. J. Magee, Acting Chief Biologist of the Department of Agriculture, in the *Agriculture Gazette*, New South Wales, April, 1942.

Dissolve 10 lbs. of copper sulphate or bluestone in 35 gallons of water in a wooden vessel. In another vessel dissolve 11½ lbs. of washing soda crystals or 4½ lbs. of soda ash (crude sodium carbonate) in 5 gallons of water. Add the soda solution slowly to the bluestone solution, stirring all the time. If obtainable add a wetting preparation, but if this is not possible just soak the

sacks for a little longer time. The sacks should be placed in the solution one at a time until they are completely wet—five minutes should be sufficient and it is also advisable to treat the twine which will be used for sewing the sacks. The sacks are removed and put through a mangle if available and dried. They are then ready for use or they can be stored. Where only a few sacks are required to be treated the quantity can be reduced to, say, quarter or one-eighth of the above quantities.

Analyses of Rhodesian Foodstuffs.

In this issue of the Journal will be found a complete and up-to-date list of Analyses of Rhodesian Foodstuffs, by the Division of Chemistry. This list has been greatly added to since July, 1937, when the first issue of Analyses of Rhodesian Foodstuffs appeared.

Cleanliness by Law.

Tobacco growers are reminded that in terms of Section 17 of the Tobacco Pest Suppression Act, as amended, they shall remove from any cultivated land on which tobacco has been grown, and destroy by 1st September in the case of Turkish type tobacco or by the 1st August in the case of other types including Virginian, all tobacco plants, including stalks and roots, which have been growing on such cultivated land prior to such date.

No tobacco plants other than those being cultivated for the immediate season's crop must be allowed to grow on tobacco farms at any time, and no tobacco plants must be allowed to grow in seed-beds after the plants are no longer required for transplanting.

Cleanliness Aids Insect Control.

OBITUARY

The month of August, 1942, has taken from our midst two outstanding figures in the agricultural industry, namely, Mr. H. M. Huntley and Mr. Duncan Black, and the Colony as a whole, and particularly the farming community, have suffered a heavy loss through the deaths of these two men.

Mr. Huntley was one of the original life tenants placed by the Founder of this Colony, Cecil John Rhodes, on his Matopo Estate, and the property has continued in Mr. Huntley's occupation ever since—a period of approximately forty years. Throughout his long life Mr. Huntley was a prominent personality in Bulawayo and in Matabeleland generally. He was very closely associated with the Bulawayo Landowners' and Farmers' Association from its inception, as well as with the Bulawayo Agricultural Society and the Rhodesia Agricultural Union and the Matabeleland Farmers' Union. He was a man of outstanding common sense and wide tolerance of views and his services as a member of the Board of the Land and Agricultural Bank of Southern Rhodesia, since it was first constituted in 1924, and to the other organisations referred to, will long be remembered with gratitude and admiration Unfortunately for Southern Rhodesia Mr. Huntley leaves no son to succeed him

Mr. Duncan Black, farming on "Selby," not far from Salisbury, was situated more favourably from the point of view of soil and climate to apply to Southern Rhodesian conditions the sound knowledge of stock and arable farming which, early in the present century, he brought with him from Scotland.

From those early days of our agricultural history Mr. Black, until the time of his death, continued to add fresh laurels to his reputation as the finest combined stock and arable farmer that the Colony has yet seen. The example which he set to his fellow-farmers in this direction is beyond all praise and not content with developing his own properties he was constantly active in introducing and successfully establishing on the land in Rhodesia young and energetic fellow-Scotsmen.

Mr. Black's pedigree Aberdeen Angus herd has been famous throughout Africa for many years, and he himself was no less widely recognised as an outstanding judge of British breeds of beef cattle. An original member of the Farmers' Co-op., Salisbury, he was for many years a director of this most successful co-operative concern; he was likewise a prominent supporter of the Rhodesia Agricultural Union and a member of the Cattle Committee of that body.

To the relatives of these stalwarts of the agricultural industry we—and all our readers, we are sure—extend our most sincere sympathy and may Southern Rhodesia never lack farming leaders of similar calibre and honesty of purpose.

Letters to the Editor.

To the Editor, *Rhodesia Agricultural Journal.*

Sir,—It seems to me that the chief factor in the control of witchweed is distance. Since witchweed grows on the maize root, and to simplify the question, let us take three distances, all of which, I think, you will agree must exist.

(1) The distance from the maize plant up to which witchweed will grow robustly.

(2) The distance from the maize plant where robust growth declines.

(3) The distance from the maize plant where witchweed will not grow.

Having determined the above it should not be very difficult to further increase the area of No. 2 by dense shade.

In this way the danger area No. 1 is clearly defined, and concentrated, and lends itself to concentrated hand cleaning.—I am, etc.,

F. L. TOWNSHEND.

Rutherdale, Shamva, July 23rd, 1942

The Chief Agriculturist's Branch has replied that in his two final paragraphs Mr. Townshend appears to have in mind the growing of a shade crop betwen the rows of maize, presumably where the latter is spaced at 6 feet or more between the rows.

Where witchweed infests the land such a practice must be strongly condemned, since wide experience has shown that this inevitably leads to an increase in the infestation by the parasite owing to the practical impossibility of ensuring the killing of every witchweed plant by hand cultivation. This is, of course, owing to difficulty labour has in spotting the plant. The very real danger of leaving even a few of the parasites to seed down will be readily seen, when it is remembered that each seed capsule contains several hundred seeds, and even a weak plant may produce several thousands of seeds.

The robustness of growth of the parasite largely depends on the vigour of the host plant, and, of course, on the number of parasites growing on the host. Where many parasites infest one host plant those which are first germinated (usually those which appear nearest the host) usually are most robust in growth, because they are first in the field. Where only a few parasites are infesting a host, the growth of those appearing farthest from the host may be just as vigorous as those near the host.

The distance from the maize host beyond which the parasite does not appear (when no other plants, including weed grasses, occupy the land) depends directly on the distance to which the lateral roots extend from the host. This may be as far as 8 feet in extreme cases, but is more usually two to four feet.

In the case of very severe infestations, such as have been seen in the past on the Witchweed Demonstration Farm, the parasites may appear evenly spread over the whole 6 feet wide interspace between the rows, and have been just as numerous in the centre of the space as nearer the maize.

To the Editor, *Rhodesia Agricultural Journal.*

Sir,—Now that the country is becoming more humus minded, do we recognise sufficiently the function, other than that of providing food to the plant, exercised by humus? Vageler stated that, second to water, humus is the most important factor in crop production. A very important factor in crop production is *aeration*; how much plant growth depends on this has probably not been realised. At the Indian Institute of Science at Bangalore hanging gardens were used over the aeration tanks of the activated sludge installation. Through an accident the air supply was temporarily cut off. Almost at once the plants began to wilt and showed clear evidence of insect attack. When aeration was resumed they quickly responded and showed extraordinary development of growth. Tomatoes gave sixteen fruits against eight in the pot and so on.

Many maize growers have noticed and remarked on the good crops that the maize plant yields when grown on land where the previous crop of sunnhemp has been only partially rotted down The crop is almost always better than when a complete rotting down has taken place. Some factor present seems with maize to completely overshadow a state of nitrogen starvation which might be expected, it would appear that this can only be the extra aeration provided as the crop progresses by air channels and spaces in which the stems of the sunnhemp have decayed Where a green crop has not preceded the maize crop it is generally noticed how hard and impervious to aeration the surface becomes, especially on our red soils. This brings us to the question then as to what degree of rotting down compost should be carried to if it is to be used for maize. It would be of value if growers were to note carefully the results obtained from completely rotted compost as against applications where a certain amount of vegetable matter had not completely decayed in the compost heap but the decay had been completed in the soil. To open up these hard soils the remedy is still more humus.

In many parts of Mashonaland we are still allowing to go to waste thousands upon thousands of tons of vegetable matter each year which, if composted and added to these hard soils, would soften them down and put more life into them.

Ruskin told us: "There is no wealth but Life," and as Mr. J. O. Steed puts it humus is a link in the chain of life—the war is teaching us what constitutes real wealth—and when this penetrates the public mind the difficulties of both inflation and deflation will be minimised.—I am, etc.,

J. M. MOUBRAY.

Chipoli, Shamva, June 6th, 1942.

The following reply has been received from the Branch of the Chief Agriculturist:—

There is one potential advantage in dressing maize on our heavy soils with partially-rotted compost which Captain Moubray has not mentioned in his interesting letter, and that is that the action of the soil micro-organisms in completing the rotting brings about the liberation of mineral plant foods such as phosphates and potash from the unavailable reserves in the soil. This is, of course, also one of the indirect effects of green manuring.

Nevertheless the use of incompletely rotted compost applied to non-legume crops, such as maize, must always be accompanied by a considerable element of risk, since its success or failure depends on the climatic conditions following germination of the crop. If a long wet spell follows germination, as has happened in several recent seasons, the soil is too cold and lacking in aeration to allow the micro-organisms to finish the rotting process rapidly, and either nitrogen starvation of the crop will result or the crop will not benefit from the compost. This has happened in several cases within our knowledge. Next season's crop certainly benefits from the compost, but some of its value has been lost for good. The same danger of loss would not exist if the partially rotted compost could be ploughed under in the latter part of the wet season preceding the planting of the maize, so that rotting might be completed before the maize is germinated in the following spring, but this is not practicable. Partially rotted compost can be applied with benefit to any legume crop, since here the danger of nitrogen starvation is absent

Again, if a farmer has partially-rotted compost and is afraid to apply it to a non legume crop (such as maize) he can pass through a quarter inch mesh screen (at a cost of about half a penny per ton) and apply the fine material to the non-legume crops and the partially-rotted coarse material can be safely applied to the legume crops and with great benefit.

On the whole the only safe policy for the farmer to follow is to apply only well rotted compost to his maize crop and to other non-legume crops. In no case should he apply partially rotted compost to winter crops, particularly the cereals

---

If all the agricultural refuse in Rhodesia were placed end to end it would go half way round the earth.

Let it take its pests with it and stay there!

Cleanliness Aids Insect Control.

Notes on a Trial Planting of Oyster Nuts

IN THE MID-MELSETTER DISTRICT.

By S. M. Sinclair, Albany, Melsetter.

About two pounds of seed was received from a friend in Kenya in March, 1940. These were planted then in spite of the unseasonable time of year. Seventy-five vines grew to maturity, of which 20 have since been cut out. Some vines were slightly touched by frost, but these all recovered.

Due probably to the fact that it was a very dry year and the vines were not irrigated, growth was very slow until the rains. From December onwards, however, growth was very rapid, and within two months the trellis was covered with a dense mass of vegetation, some runners being up to 60 feet in length.

By March, a few of the male plants were flowering, the first flowers being observed on March 7th. Flowering of males con tinued fairly profusely, but no female flowers were apparent.

In the winter of 1941 half the vines were lightly pruned. Subsequent results showed that at least $\frac{3}{4}$ of the growth ought to have been cut away.

During the summer season of 1941-42 growth was so heavy that the trellis broke down. The runners were interlaced on the top of the trellis in an inextricable mass, and the male plants in particular ran amok, the biggest of them extending for 100 feet on either side of the main stem.

Only five female plants were identified, and these bore one or two fruits each.

There seems to be no doubt that the light crop was due to the unchecked growth and the fact that the vines were strangling one another, and it is possible that if the vines had been correctly spaced and pruned there would have been a light crop in the first season, with a corresponding increase in the second season.

Observations.

(1) The male plants are the stronger growers and need to be thinned out and heavily pruned.

(2) The rate of growth greatly exceeds that recorded in Kenya. It is evident that in Melsetter at any rate annual heavy pruning will have to be carried out, with possibly a wider spacing than that recommended by the Kenya authorities.

(3) The crop was given only one application of pig manure in 1940, and nothing in 1941, and in spite of this, on an indifferent soil and within 50 feet of a 40-year-old bluegum plantation, it

Mature Fruit or Gourd of Oyster Nut.

made heavy growth. Nevertheless, it is reasonable to suppose that it will need heavy dressings of organic manure in order to produce heavy crops annually.

(4) The nut is supposed to undergo treatment in order to remove the bitter principle in the husk. In practice it was found that well-ripened nuts had no suspicion of a bitter taste after soaking for four hours each time in three changes of clean water.

(5) The ripe nut is very palatable, with an attractive flavour the flesh being similar in texture to a brazil nut.

(6) The cost of trellising would be high except where timber is fairly plentiful and close at hand. About 200 uprights go to the acre and 100 cross bearers of 30 feet each, together with the necessary steel wire. This cost would be neutralised if plants were trained into growing trees. This is practised with success by natives in Kenya, and there is no reason why it should not be equally successful here.

(7) The general behaviour of the crop, in spite of bad handling due to inexperience, has been highly satisfactory, and it seems that an extensive trial would be well justified over all areas in the Colony of high rainfall or having irrigation.

Charcoal for Gas Producer Plants.

By the Conservator of Forests in Consultation with the Technical Sub-Committee on Producer Gas Plants.

Experience gained in this colony and in other parts of the world has shown that the type and quality of charcoal used in small stationary and mobile gas producers has an extremely important influence on the proper working and efficiency of these plants. Charcoal made from unsuitable timber or which has been under or over-burnt or which contains carbonized bark, sand or soil will give the users of such plants considerable trouble in one way or another.

The production of good charcoal free from these defects does not present any great difficulties if a few simple instructions are carried out and the necessary precautions are taken by the charcoal burner.

Hardness and Density.—Hard heavy charcoals are best. A hard charcoal will stand handling without excessive crushing and breaking and so can be carried in bags or the generator without the production of much fine material. The heavier the charcoal the higher is the heating power. It is obvious also that a given weight of dense charcoal will occupy less storage or carrying space than a light charcoal.

Cleanliness.—This is a most important factor, as the burning of charcoal which is contaminated with soil, sand or other mineral matter results in the formation of excess clinker in the fire zone of the producer. The usual pit or mound methods of burning charcoal in this colony lend themselves to the production of dirty charcoal, but provided the charcoal is washed most of the contaminating substances can be eliminated. The significance of cleanliness as regards engine and producer performance as well as cost may be gathered from the fact that recently twelve bags of carelessly prepared charcoal, after grading and cleaning, produced only six bags of material suitable for a producer gas plant. The amount of dirt, grit, etc., should not exceed 0.3% of the moisture free weight of the charcoal.

Volatile matter.—Commercial charcoal is never pure carbon, but contains various compounds such as gases and tarry substances. When the charcoal is heated above a certain temperature, these compounds or "volatile matter" are given off. Partially carbonised charcoal would have a high percentage of volatile matter. The elimination of the tarry portion of the volatile matter is the most important as regards engine performance as any excess will lead to trouble in the generator and the engine.

A charcoal which contains less than 25% of volatile matter, excluding moisture, may be considered satisfactory for producer-gas purposes.

Ash.—The amount of ash left after burning charcoal in a generator is of importance as too much ash may result in an accumulation of clinker in the fire zone at the base of the generator. Charcoal giving an ash with a high silica content is particularly to be avoided.

In general charcoal having an ash content of less than 5% is satisfactory, but below 3% is preferable.

Moisture.—The use of wet charcoal will cause the engine to falter and condensation may occur in the coolers and filters. Water may also enter the engine itself. If charcoal is sold by weight and it contains excessive moisture it means that the purchaser is paying for more than the true weight of the charcoal which will be available for generating gas. The extra cost of transport to both parties is also a consideration.

When removed from the kiln charcoal has a very low moisture content but it rapidly absorbs moisture until it is in equilibrium with the atmosphere. Charcoal which has been quenched after burning should be spread out to dry on a clean floor. It also follows that charcoal should never be stored under damp conditions In this colony, the moisture content should seldom exceed 10% of the weight of the charcoal while in the dry months it would fall to 4% or less.

Size.—For use in small producers the charcoal must be graded to obtain uniformity in size of pieces

It has been found that a satisfactory grading is obtained by passing the charcoal through a $1\frac{1}{4}$ in. mesh sieve and eliminating the fine particles which are not retained on a $\frac{1}{4}$ in. mesh sieve.

The resulting product should be a fairly uniform mixture of pieces varying in size from $\frac{1}{4}$ in. to $1\frac{1}{4}$ ins. It is advisable that the proportion of the smaller pieces, below $\frac{1}{2}$ in. should be less than one third of the total volume, since these smaller grades tend to give a greater consumption per ton mile, less power and result in a greater accumulation of dust in the dust traps and filters.

Local timbers for charcoal.—Most of the more common native and exotic trees growing in this colony are hard heavy woods which give suitable charcoals and the following can be recommended:—

Botanical name.	Common name	Shona.	Sindebele.
	Exotic.		
Acacia mollissima	Black wattle		
Eucalyptus spp.	Gum trees	(Most common varieties)	
	Native.		
Baikiaea plurijuga	Rhodesian teak	—	Umgusu
Brachystegia randii	—	Musasa	Igondi
,, *woodiana*	—	Mufuti	Umtajabele
Burkea africana	Wild Syringa	Mukarati	Umnondo
Copaifera coleosperma	—	—	Umtjibi
Copaifera mopane	Mopani	Musaro	Ipani
Isoberlinea globiflora	—	Munondo	Umnonjwane
Monotes glaber		Muwara Mushawa	—
Uapaca kirkiana	Mahobohobo	Muzhanzhi	—

The well known tree *Parinarium mobola*—Mahash, muwatja, mjakata or grysappel—should on no account be used for charcoal owing to the very high silica content of the charcoal ash produced.

FACTORS AFFECTING YIELD AND QUALITY OF CHARCOAL.

Wood must be reasonably dry.—The yield of charcoal is in the neighbourhood of 25% of the weight of dry wood, hence if green wood is used it means that a portion of the wood in burning must be consumed in getting rid of the moisture before carbonization can take place. It is possible for a cord of freshly cut wood weighing say 2 tons to give less charcoal than a similar cord if it weighed 1½ tons as dry timber. Besides giving a lower yield green wood also produces a brittle charcoal.

Freshly felled wood should be allowed to dry for some three months before carbonisation.

The wood should be barked.—Bark contains a relatively large percentage of silica, grit etc. and charcoal made from unbarked wood will leave a high ash residue on burning. In itself bark does not give useful charcoal and on account of its insulating properties it may cause uneven charring. Barking wood at the time of felling is not only easier but accelerates drying and removes the danger of attack by bark beetles.

The wood must be sound.—Wood that is decayed through rot or insect attack makes an unsatisfactory charcoal which is soft and brittle. Rotten wood takes up valuable space in the kiln and results in low yields.

The wood must be of one species per charge.—Mixing different kinds of wood in any one burn results in loss of yield and uniformity, because of the difference in density and combustibility. It would be possible for one species to be burnt to ashes before the other species had completed carbonisation.

The wood billets should be fairly uniform in shape and size.—Straightness of the billets is important to allow of as close packing as possible and to ensure maximum yield. A wide range of diameters means uneven carbonisation i.e. the smaller diameters will have charred before the larger have completed the process.

In practice it has been found that billets from 2 to 7 inches diameter may satisfactorily be carbonised in any one burn. Billets of larger size should be split lengthwise or crosscut into discs about 6 inches in depth. If splitting or crosscutting are likely to add too much to the cost, the billets should be graded to uniform ranges for each burn. Carbonisation will of course take longer with the larger sizes as moisture must be removed from the centre outwards and as carbonisation proceeds from the outside inwards.

Manufacture of charcoal.—To make good quality clean charcoal and to obtain maximum yields steel retorts or brick kilns should be used.

At present steel is difficult to obtain but a simple inexpensive brick kiln in two sizes (holding approximately one and three cords respectively) has been designed by the Fuel Research

Institute of South Africa. The smaller size, slightly altered, has been tested out by the Forestry Division at Salisbury and the Mtao Forest Reserve with very satisfactory results. As constructed the kilns each carried a little over a cord of well packed Eucalyptus wood in 3 feet lengths and diameters ranging between 3 and 7 inches. The final yield after grading to between ¼ in. and 1 in. averaged 750 lbs. or 10 bags per kiln.

Summary of instructions.—

(1) Use only suitable species of timber and only one species per burn.

(2) Bark and dry the timber for at least three months.

(3) Use timber of a uniform size and shape in each burn.

(4) Grade the charcoal to the recommended sizes before sale or use.

(5) Burn the timber in a properly constructed kiln, but if primitive methods of burning are adopted take particular care with the cleaning and grading of the charcoal.

(6) It is suggested that those who intend manufacturing charcoal for sale would give confidence to users of their product by stating the name of the timber used, the method of burning, the grades to which the charcoal conforms, whether it has been washed and the net weight of the consignment.

BRICK KILNS DESIGNED BY THE FUEL RESEARCH INSTITUTE OF SOUTH AFRICA

I.—Small Brick Kiln.

(a) **Erection of Kiln.**—The kiln is erected on a concrete foundation 6 inches thick and 12 inches wide, or on not less than three courses of 14 in. brickwork laid in lime or cement mortar. The brick walls (except the two upper courses) are built with dagga. The spaces between bricks must be well packed with mortar, in order to avoid air leaks, and the inside of the walls must be clean to prevent pieces of mortar falling into the charcoal. Cement is used as mortar in the two upper courses. These bricks are liable to be knocked about during loading and unloading and hence it is advisable to bind them more firmly.

The floor is levelled and the bricks packed in as shown in the plan. The bricks are then grouted in with dagga.

(b) **Wood.**—It is fairly certain that any reasonably hard wood can be employed. The wood should be debarked when cut and then allowed to dry for at least three months. Wood of high moisture content gives a brittle and porous charcoal. Unless the wood is very straight the pieces should not exceed about 3 feet in length. The object of this is to ensure tight packing in the kiln. The thickness of the wood should lie between 2 inches and 7 inches, thicker wood being split. It is advisable to have all wood, in one burn, of approximately the same diameter, preferably with a variation of not exceeding 3 inches. This is to ensure that all the wood should be carbonized to the same extent. Different species of wood should not be mixed in any one burn.

(c) **Packing of wood in the kiln.**—The bottom layer of the wood should consist of poles of not more than 4 inches in diameter and should be packed parallel to the short axis of the kiln. (See fig. 3.)

The remaining wood is packed parallel to the long axis of the kiln. It is advisable to pack the lower layers and the sides of the kiln with wood of 2 to 4 inches diameter in order to ensure thorough carbonization. At the upper end of the kiln, on the side opposite to the chimney, a space of 1 foot wide, and about 8 inches deep should be filled with thin twigs together with split wood and partially burnt wood, from previous burns, for kindling. Every effort should be made to have the whole charge tightly packed to reduce fire space.

(d) **Burning.**—Two sheets of corrugated iron, supported on the wall and on two or three iron supports are placed over the kiln near the chimney end. All air inlets at the base of the kiln, with the exception of (a1) and (a2) (See Fig. 2) are sealed by placing a brick in the opening and covering with earth. The chimney is opened and the kindling lit by pushing a burning torch through the two air holes Y1 and Y2 at the top of the kiln. (See fig 2). The torch is made from waste or sacking soaked in paraffin.

Allow the kindling to almost burn away. Pack further split wood on to the fire and allow a strong fire to develop. The flames should attain a length of about 3 feet.

N.B.—Care must be taken to obtain an even strong fire across the width of the kiln in the kindling area.

Cover with the remaining two iron sheets and seal with earth. Seal Y1 and Y2 with bricks and clay.

It is essential that an immediate draught must set in through the kiln. This is obtained if the fire in the kindling zone has been well established.

In case no wind is blowing, the corners of the iron sheets nearest the chimney must be lifted and a brick inserted to allow the smoke to escape through the opening. The kiln can in some cases be left in this state for about half an hour before the sheets are again sealed.

The smoke will now be warm enough to cause a draught through the chimney.

If sufficient draught cannot be obtained, the fire does not spread and the wood that has been ignited simply burns to ash. This may occur when very wet wood is used. To remedy this, the height of the chimney should be doubled.

If a moderate or a strong wind is blowing it is possible to effect a draught immediately through the chimney by placing two bricks on the windward side of the chimney opening. As illustrated in figure 4a and b.

The fire burns from the top to the bottom before proceeding through the charge.

In the ideal burn the fire should reach air inlets a1 and a2 at the same time.

When carbonization in this section is completed, as seen by glowing lumps of charcoal falling into the furrow leading from the inlet, a1 and a2 should be closed and b1 and b2 opened. (X1 and X2 are opened to determine whether the wood against this wall has been thoroughly carbonized. If this is not the case X1 and X2 may be left open until the fire has reached these points). Thus successive sections of the oven are carbonized. This procedure is followed until the final section is carbonized. In the event of carbonization being more rapid on one side, the air hole on this side should be closed and extra air admitted on the opposite side until carbonization on the other side has reached the same stage. Air holes X1 and X2 are used when carbonization is irregular at the commencement. Thus, suppose the fire reaches a1 before it reaches a2, a1 will be closed and X2 opened. If the fire has already reached X2 this is closed and b2 opened. The kiln is left in this state until the fire has reached a2. Then b1 is opened and a2 closed. Normally from this stage onwards carbonization will proceed uniformally throughout the rest of the kiln.

It is advisable to follow the carbonization at intervals of one half hour during test burns.

With a strong wind blowing diagonally or directly against the side of the kiln, irregular burning may result. In this case a small piece of iron sheeting should be placed over the inlet to prevent the wind from blowing directly into it.

N.B.—The operator must be careful when observing the position of the fire through the air inlets when a wind is blowing as in some cases fairly long flames are forced out through the inlets.

When carbonization of the final section supplied by air through holes d1 and d2 is complete, these holes are sealed and the chimney is covered with a piece of flat iron and sealed with earth. The whole burning operation will take 18 to 24 hours. The kiln is now allowed to cool for about 20 hours. During this period access of air must be prevented by sealing all places where smoke escapes. If this is not done serious loss of charcoal may result and the charge may ignite on opening the kiln.

(e) **Opening of the kiln and removal of the charcoal.**—The earth seal over the edge of the covering sheets must be carefully removed to prevent any dirt from falling into the charcoal. Any glowing spots can easily be quenched with water. This wet charcoal must be spread on sheets and left to dry in the sun. Although the operation of charging the kiln and carbonization can be performed in rainy weather, it is not advisable to discharge the charcoal under such conditions.

(f) **Crushing and grading of the charcoal.**—Partially burnt charcoal which may be found on the floor or along the sides of the oven should be used for kindling or reburnt. Such charcoal can be recognized by a reddish tint.

The charcoal to be used in gas producers must be well graded, and should pass through a 1-inch or 1¼ inch screen and be retained on a ½-inch screen.

Crushing may be carried out by hand using a pestle weighing about 15 lbs. and having a flat head of $\frac{3}{8}$ inch mild steel measuring approximately 10 inches by 10 inches. The back of a shovel may also be used.

The material should be crushed on a cement floor. Screening may be carried out by using the ordinary diamond digger's "dummy."

LARGE BRICK KILN (See fig. 6).

The kiln is erected, packed and operated in the same manner as the small brick kiln, except that in the large kiln two air holes on each side are open at the same time, thus a1, a2 and b1 and b2 will all be open when burning the first section. These are then closed and c1, c2, d1 and d2 are opened. As to the time of burning and cooling there is no essential difference.

Acknowledgements.—In the compilation of this article reference has been made to the following:—

(1) The Fuel Research Institute of South Africa. "Brick Kilns for the Production of Charcoal for Gas Producers."

(2) Forest Products Research Institute, Princes Risborough. Various publications on Charcoal Manufacture.

(3) Standards Association of Australia. Emergency Standard for Wood Charcoal—No. (E) D3002 -1941.

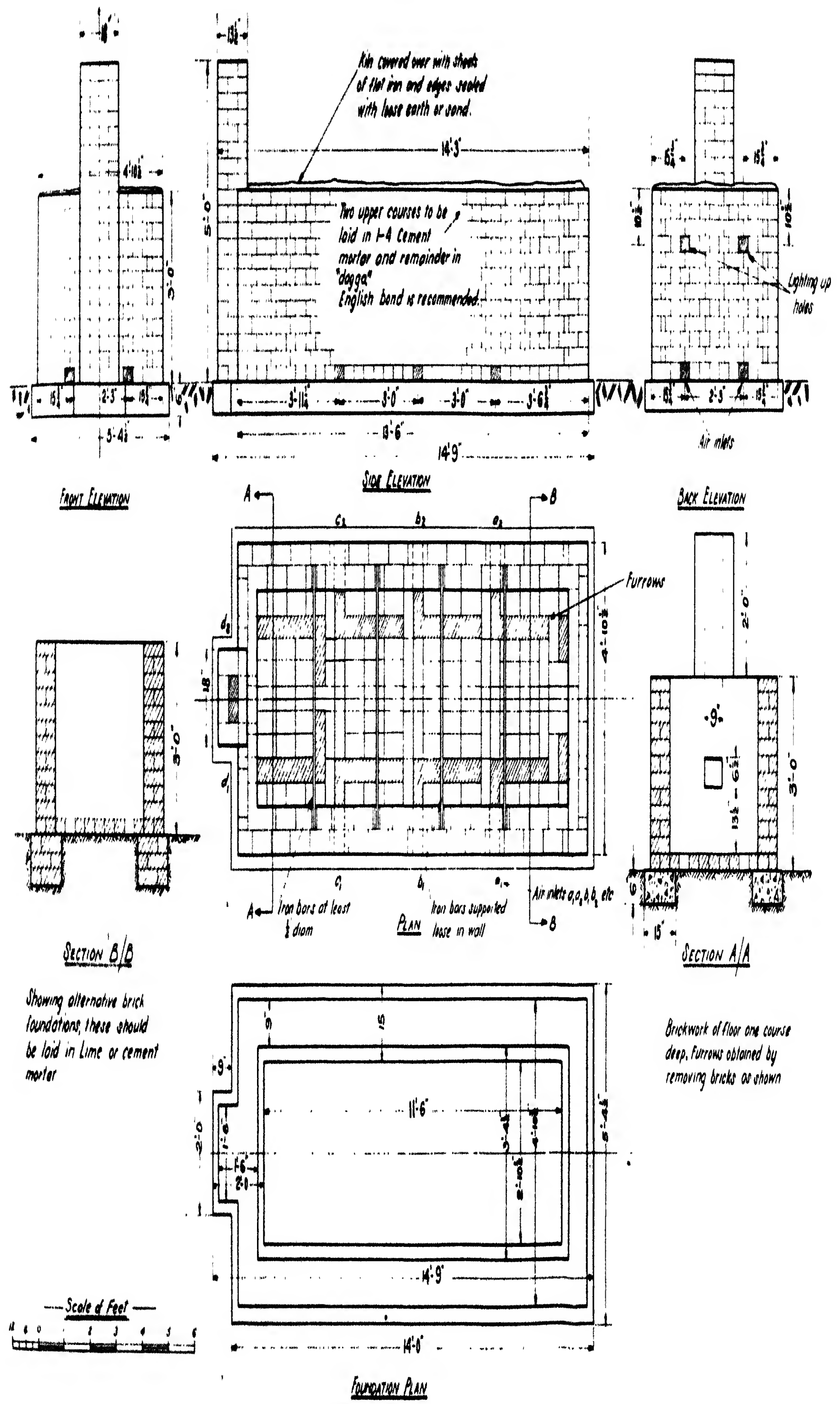
(4) The Forests Commission of Victoria "The Manufacture of Wood Charcoal."

MY BEAN.

I had a bean,
Its leaves were green,
It grew up straight
About four foot eight.

Some locusts came,
And it became—
My bean of fame—
A thing of shame.

David Pascoe (age 10), Selborne School, Salisbury.

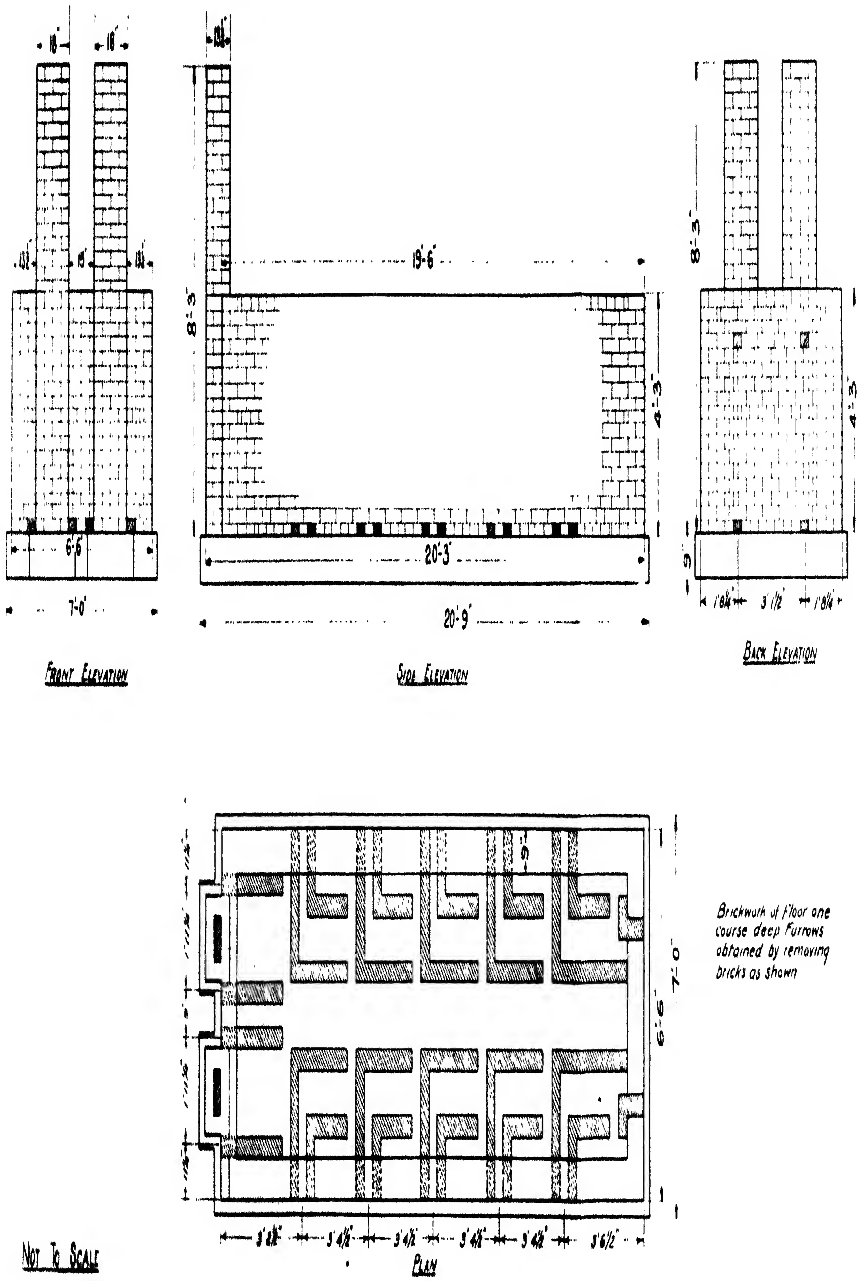


SMALL CHARCOAL KILN

Fig I

With acknowledgement to The Fuel Research Institute of South Africa

Issued by The Forestry Division
Dept of Agriculture Box 387
Salisbury



LARGE CHARCOAL KILN

Fig 6.

Method of Construction identical with that of smaller kiln.

with acknowledgement to the Fuel Research Institute of South Africa.

Issued by The Forestry Division
Dept of Agriculture, Box 387
Salisbury.

Traced by Irrigation Dept 28-7-42

Crushing may be carried out by hand
about

FIG 2

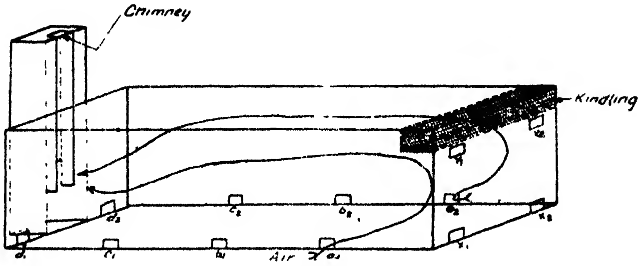


FIG 3

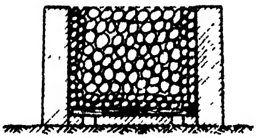


FIG 4

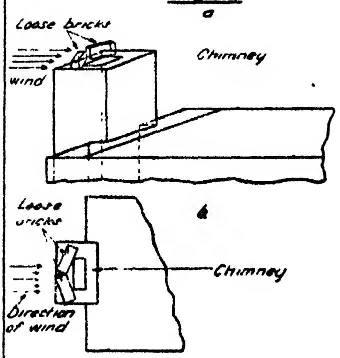
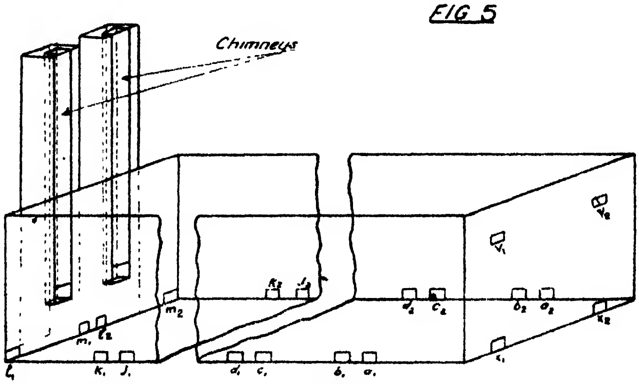


FIG 5



With acknowledgement to the
Fuel Research Institute
of South Africa

Issued by The Forestry Division
Dept of Agriculture
Box 387 Salisbury

Bulletin for Cotton Growers.

By G. S. CAMERON,
Cotton Research and Industry Board

The supply of the previous Cotton Bulletin No. 1157 having become exhausted, it is now necessary to write a revised one. This is also called for owing to the far-reaching developments brought about in 1941 as a result of the Government's decision to guarantee the price of cotton for a period of five years. This decision was taken in conjunction with the scheme to establish a Cotton Spinning Mill in the country The Mill is being erected at Gatooma and will probably be ready in time to deal with the 1943 Cotton Crop

The immediate effect of the stabilisation of cotton prices was a five fold increase in acreage and a correspondingly larger production in 1942. All indications point to acreage and production continuing to increase under the stimulus of the guarantee of a stable and remunerative price

The following notes are based partly on experience gained on the Cotton Breeding Station, Gatooma, and partly as a result of numerous talks and discussions with experienced cotton growers in various parts of the country Here it may be stated that what is learned from the experience of others is quite often as useful, sometimes even more so, than what one learns from operations on one particular place situated in one part of the country

The question as to whether a farmer should grow cotton or not is one which he must answer for himself It is the writer's conviction that many more farmers ought to be growing cotton than are doing so, but it is difficult to overcome prejudice against a crop which did not come up to the extravagant expectations that once were, rather foolishly, held about it

Those who have been growing cotton regularly over a period of years know by experience that the crop is a payable one, although in years of low prices the cash return may not be great This fluctuation in prices has now been overcome by the Government guaranteeing fair prices over a period of years. As a rotation crop its benefit is most noticeable, especially with maize There is also the value of the cotton seed for fattening cattle and the grazing value of the cotton plants after the crop has been harvested

Cotton as a Rotation Crop.—For a number of years farmers have been remarking on the distinct increase in maize yields following cotton, and this has been very marked on the Cotton Station at Gatooma. It is worth mentioning that the increase in maize yields following cotton has been noted in the majority of maize producing districts as well as in Matabeleland and Northern Rhodesia. Just why cotton should be such a good rotation crop is still a matter for speculation. There are a number

of good reasons put forward, mostly quite sound, but no definite claim can be made for any of them until fully investigated, and that is likely to take some time yet. Perhaps the beneficial effects are not due to any one particular factor, but to a combination of several. For the time being it is sufficient to know that the benefit does exist, and academic investigations as to the why and wherefore must wait.

Choice of Land.—Cotton is very tolerant in the matter of soil, but it cannot grow properly where there is any tendency for soil to become waterlogged. Put in another way, COTTON CANNOT STAND WET FEET. It is very necessary to stress this fact in block letters, because it is a point which new growers fail to appreciate until it is too late—and then they blame cotton. Even poor land, provided it is well drained will produce a cotton crop, but this is not to say that cotton prefers poor land—it does not. On the other hand, it is not economic to put it on very rich soil which would give a better financial return under other crops. A number of maize growers have made a practice of planting cotton on land which has ceased to be sufficiently productive for maize. By this means they are enabled to get another maize crop off the land before putting it under green manure. This is merely an expedient as it is not claimed for cotton that it takes the place of a green crop ploughed in. It is better to plant cotton before land has become too worn out, and add a dressing of farm compost, say five tons to the acre. Not only will this ensure a good cotton crop, but it is also a sure method of obtaining at least two good maize crops following the composted cotton.

Preparation of Soil.—As cotton requires to be planted early, it is necessary to have the land well prepared to ensure a good seed bed. If the land is disc harrowed immediately after ploughing in the autumn, it should be possible to dry plant the cotton if planting rains threaten to be late. It is necessary here to utter a word of caution against planting "too" early. Supposing planting rains arrive early in October, as sometimes happens, it would be risky to plant cotton then, as the seed would germinate, but there is always the risk of a drought after early rains, and the young seedlings might die off.

As a rule it is better to wait until the first or second week in November.

Perhaps it might be as well to explain that the necessity for early planting is not so much on account of falling temperatures in the autumn, but in order to get early flowering. The earlier the flowering, the less damage there is likely to be from Bollworms. In some ways "bollworm" is a misnomer. The American bollworm is the same pest as the "Top Grub" in maize, or the tomato worm, or the worm that does so much damage to citrus. In the case of cotton the greatest amount of bollworm damage is done during the flowering period. If it is remembered that every cotton flower is a potential boll, then we realise the necessity for getting the greatest number of flowers produced and fertilised before bollworm attack reaches its maximum.

Planting.—There are two outstanding points in connection with the planting of cotton: (1) DO NOT PLANT TOO DEEP, and (2) USE PLENTY OF SEED. The first point is stressed

because it sometimes happens that, after the seed has been planted, there may be a heavy tropical downpour of rain which batters the surface of the soil, and this dries into a hard crust if the rain is followed by a spell of hot dry weather. This happens more frequently than is generally recognised, and it is on this account that shallow planting is strongly recommended. If planted too deep the seed may germinate, but the young seedlings will not be able to push their way to the surface and break the crust which has formed. For the same reason it is necessary to use plenty of seed. The seed rate generally recommended is 25 lbs. to the acre for machine delinted fuzzy seed and about 12 to 15 lbs. for acid delinted seed.

Depth Regulators.--To ensure uniform depth of planting the use of depth regulators is recommended. They consist of iron shoes which are fixed as shown in the accompanying photograph. In addition to preventing the planter from going too deep, the effect of the shoe passing over the soil tends to make a smooth track in which the cotton seed is dropped. A few of these depth regulators are still available, and may be had on payment by applying to the Cotton Ginnery, Gatooma After the existing supply is finished it will be necessary to obtain locally made depth regulators. These are sturdy and well built but are more expensive than the pre-war imported stock.

The tracks made by the depth regulator shoes will scour out in the wet weather if they run across the contour of the land instead of parallel with it. This warning may sound very elementary to experienced farmers, but the fact remains, nevertheless, that it is necessary to mention this cautionery note.

Machine Planting.—Where a planter equipped with the orthodox cotton seed attachment is available, it is advisable to plant the fuzzy seed as such attachments are too wasteful of acid delinted seed.

Where, however, the planter has no cotton seed attachment, only acid delinted seed can be planted. The planter is set up as for maize planting, but the smallest holed maize plates obtainable should be used, or preferably a small bean plate. As less seed is required per acre, the higher cost of acid delinted seed is more or less cancelled out. The planter should be set so that the rows are 36 inches to 42 inches apart.

Hand Planting.—If it is intended to plant by hand it is as well to obtain the machine delinted fuzzy seed. The reason for this is that Natives have a tendency to plant too many pips per hole, and if they do this with acid delinted seed, it works out on the expensive side. Four or five seeds per hole should be dropped at 6 to 9 inches apart in the row and very lightly covered over with loose soil. As is the case with machine planting, the rows should be 36 to 42 inches apart.

Thinning Out or Singling.—If planting has been properly carried out, and providing the weather conditions have been favourable, the young seedlings should begin to appear above ground after four to six days. By the tenth day the young plants should be distinctly visible in clearly defined rows. By the time the young plants are four to six inches high they should be

thinned out (singled) to approximately one plant at intervals of 6 inches apart. If the land is dirty with weeds it would be advisable to put the cultivators through before thinning.

Cultivating and Weeding.—The number of cultivations required will depend upon the cleanliness of the land or otherwise. Some farmers find it possible to thin out and hand weed at the same time. Others maintain that this is not possible, and prefer to make two operations of what should be carried out in one. It seems to depend upon the labour, and to a greater extent, how it is supervised.

The number of subsequent cultivations depends, as already stated, on the cleanliness of the land. One hand cultivation and two or three cultivations with the cultivator ought to be sufficient, normally, but it should be remembered that cotton offers an opportunity of getting land thoroughly cleaned. Care should be taken that the cultivators are not set too wide. It is the early cultivation that counts, and if cotton is kept clean from the start there should be less need for subsequent cultivations.

Early Growth.—In the early stages cotton does not grow quickly, and this should be noted by farmers who grow the crop for the first time. At the beginning of the season the young plants are getting their roots well down into the soil, and it is not until they have done so that they begin to grow vigorously above ground.

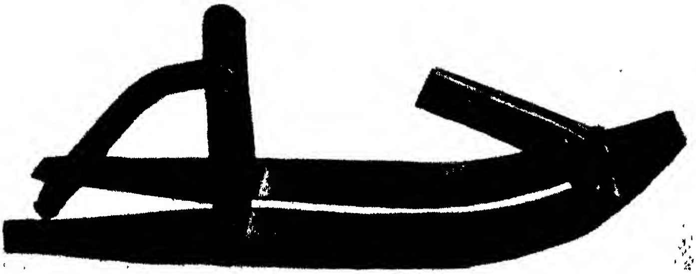
Fertilisers.—The use of artificial fertilisers on cotton is not recommended. In Southern Rhodesia the surface application of artificial fertilisers to cotton produces no response, even when heavy dressings are applied. It is thought, and it may well be, that cotton, being a deep rooted plant, gets the residual benefit of fertilisers applied to previous crops. If a farmer wants maize to follow his cotton crop, then he could apply raw rock phosphate to the cotton, but it is the subsequent maize crop and not the cotton which would derive the benefit.

Compost.—Although cotton does not respond to artificial fertilisers, it reacts immediately to applications of farm made compost. Various dressings have been applied to find out which is most economic. So far it would appear that applications in the neighbourhood of five tons of compost per acre are the most economically effective. Composted cotton gets away much quicker at the beginning of the season and the benefit of the compost is most marked in a year of long protracted drought. Compost has a definite effect in increasing the yield of seed cotton per acre. All this has been very clearly demonstrated on the Cotton Breeding Station at Gatooma. So much so, that the fattening of steers as chillers, is an established part of the farming operations in order to get a sufficient supply of dung and urine to convert the farm waste material into compost. The compost is spread on the land and ploughed in. A comprehensive set of trials carried out on the Cotton Station proved that it is better to plough in the compost than to harrow it in.

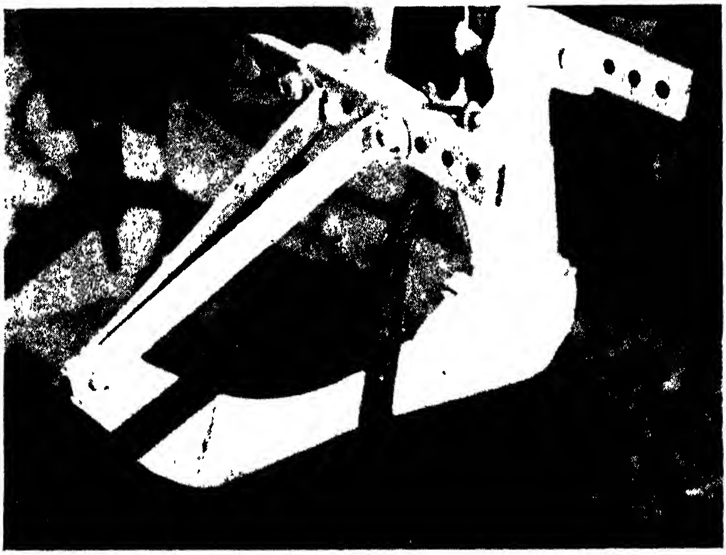
Bulletins giving instructions for the manufacture of compost are obtainable from the Department of Agriculture in Salisbury, and short notes are to be found in the "Rhodesian Diary and Businessman's Calendar."

Cotton Station Gatooma. View of the breeding plots, 1942.

Single Plant Selection, Gatooma, 1942.—Early-prolific-hardy-good staple and ginning percentage. Bolls open well but are rather small.



One of a pair of depth regulators for cotton planting machine



Method of attaching depth regulator to planter.

Harvesting.—When the first cotton bolls begin to open towards the end of April or beginning of May, according to whether the crop was planted early or not, it is then advisable to look into the crop and see whether it is likely to be a heavy one. One can judge this by the number of full grown but unopened bolls on the plants. If the plant is carrying well formed bolls up to the top the chances are that the crop will be a heavy one and may necessitate two pickings. If there was a heavy bollworm attack when the top flowers were forming there is not likely to be much of a top crop. When this happens it is well to make one picking only and wait for all bolls on the plant to open. If it is an early season this may take place about the end of May or the beginning of June. In 1942 the cotton on the Gatooma Station was ready for picking in April, but it was such an exceptionally early season that it cannot be considered normal.

Native labour in Southern Rhodesia does not seem to adapt itself readily to cotton picking, but much depends on the condition of the crop, together with the amount of supervision.

With natives who have not had previous experience in picking cotton it is as well to let them practice for two or three days, under supervision, before setting their daily task. If the crop has grown tall and rank, picking is more difficult and allowance should be made accordingly. Short, heavy bearing plants which have shed most of their foliage are the easiest to pick, and under such circumstances the task can be increased.

The most straightforward and best way to find out whether the cotton is ready for reaping, and, at the same time, discover the daily task to be set, is to try one's own hand at picking. To do an hour's picking of cotton, and then weigh up the result, can be both helpful and illuminating. (The writer's experiences in this connection have been rather humiliating).

Another point worth mentioning is that cotton picking can start at sunrise if need be, whether there is a heavy dew on the cotton or not. Quite a number of farmers got hold of the notion that cotton must not be picked until well on in the forenoon. Where the latter idea originated from is not known, nor does it matter, because it is quite wrong as far as Southern Rhodesia is concerned. As much attention as possible should be paid to clean picking, as the cleaner the cotton, the higher the grade and consequently the price. From this point of view it is well to instruct the pickers to start off with only picking the fully opened and matured bolls. This should give a very clean cotton. Subsequently the rest of the cotton can be picked. Admittedly this procedure is only practicable with a fairly heavy crop, which requires two pickings. Much as clean picking is desired, it may not prove economical to go too far in insisting on clean picking, as the increased cost of picking due to the smaller task may exceed the premium obtained for the better grade.

The number of pounds of seed cotton picked per man per day, on the Cotton Station at Gatooma (1942) is given in the following table by categories. Farmers with good cotton crops should do better than this as cotton picking is not always a straightforward operation on the Cotton Station. Daily pickings are reduced by the fact that small plots, progeny rows, etc., have to be harvested separately.

SUMMARY OF COTTON PICKINGS.

Cotton Station, Gatooma, 1942.

Expressed as percentage of Native Labour able to pick categorical amounts of seed cotton per man per day.

(Average of first and second pickings).

2%	of the	labour	picked	between	30	and	35 lbs.
2%	,, ,,	,,	,,	,,	35	,,	40 ,,
9%	,, ,,	,,	,,	,,	40	,,	45 ,,
18%	,, ,,	,,	,,	,,	45	,,	50 ,,
24%	,, ,,	,,	,,	,,	50	,,	55 ,,
38%	,, ,,	,,	,,	,,	55	,,	60 ,,
6%	,, ,,	,,	,,	,,	60	,,	65 ,,
1%	,, ,,	,,	,,	over	65		,,

The average yield of seed cotton per acre was 650 lbs.

The crop opened earlier than usual and was over-ripe before it was possible to arrange for the harvesting. This meant that the cotton was easier to pick as it came away freely from the capsules, and there was very little "pulling" to be done. One should not expect such easy picking conditions in, say, a year of late autumn rains.

RATOONING OF COTTON AND/OR ALLOWING IT TO STAND OVER IN THE FIELD FROM ONE SEASON TO ANOTHER IS PROHIBITED.

It is necessary, by law, to have the cotton plants uprooted by a date specified in the Government Gazette. This date, which may be altered from year to year, is usually fixed for the first day in October. Should a cotton grower not uproot his cotton plants by the date specified, he becomes a menace, not only to himself and his immediate neighbours, but to the whole district for miles around.

When cotton is ratooned, or allowed to stand over, it becomes a natural insectary for breeding up and disseminating several of the worst insect pests injurious to cotton. Among these are the Sudan bollworm, Jassids, and various stainers.

American Bollworm (not to be confused with American boll-weevil, which does not occur in Africa). This pest has been referred to earlier in this bulletin. It is now the most serious insect enemy of cotton, and the only way to counter it is by early planting, early thinning and cleaning. In other words, by doing everything possible to ensure early flowering of the crop. This is also hastened by the application of farm made compost.

GINNING AND MARKETING.

All cotton growers who are on the books of the Ginnery receive, well in advance of the ginning season, full advice on the procedure of handling the cotton crop. Any growers who obtained their planting seed from a source other than the Cotton Ginnery should get into touch with

The Manager,
Gatooma Ginnery,
P.O. Box 124,
GATOOMA,

and ask for full details.

The following is a general outline of procedure:

Packing of Cotton.—Seed Cotton is generally packed into woolpacks for despatch to the Ginnery, from which woolpacks are obtainable on hire. As fresh supplies are now difficult to obtain the woolpacks should be handled with care. The cotton may be packed tightly without detriment and the ideal weight is 450 lbs. of Seed Cotton per Woolpack. When the woolpacks are being filled it is usual to hitch the four corners of the open end to upright poles set in the ground This keeps the woolpack open, and permits a boy to trample the seed cotton into the pack especially while the bottom half is being filled.

Marking of Woolpacks.—Growers who have their own woolpacks should stencil their name or initials on the top flap of each woolpack.

Growers who obtain woolpacks on hire from the Ginnery will be supplied with "Tags," pieces of cloth with their initials stencilled on, which tags are to be sewn securely to the top flap of the woolpacks which will be sufficient for correct identification of the packs on arrival at the Ginnery.

Delivery of Cotton.—Cotton may be despatched to the Ginnery as soon as ready and convenient. Railage is for Grower's account, but cotton may be consigned railage forward. Growers are supplied with forms on which to advise despatch of Seed Cotton and give instructons regarding disposal of seed, etc.

Ginning Fee.—The charge is a 1d. per lb LINT plus commission and charges at 3%.

Payment for Crop.—After receipt and examination of the seed cotton an advance of approximately 75% of the Government guaranteed price will be paid on the anticipated weight and grade of the lint.

Most growers prefer to have the advance only when they have completed deliveries. Growers desiring an advance on each delivery should advise the Ginnery accordingly when giving advice of consignments

The seed remains the property of the grower and is dealt with in accordance with instructions received. Thus the grower may order return of his seed for cattle feed and or certain quantity of seed for planting or he may order the seed to be sold to best advantage by the Ginnery. In the latter case it will be placed into Seed for Planting Pool if strain type and seed soundness warrant it, otherwise in cattle feed pool.

Final payment is made after close of the ginning season, on basis of actual ginning outturn and final grading of lint, plus proceeds of sale of any seed.

Guaranteed Prices.—The Government guarantee, which took effect with the 1941 crop, stabilising the prices for a period of five years at 9d. per lb. Lint top grade and corresponding prices for other grades. The quality of cotton is determined by three factors:—

(a) GRADE (i.e. cleanliness).

1. Strict Good Middling and above.
2. Good Middling.
3. Strict Middling.
4. Middling.
5. Strict Low Middling.
6. Low Middling and below.

(b) COLOUR.

1. Good colour.
2. Very lightly spotted.
3. Yellow spotted.
4. Yellow tinged.

(c) STAPLE.

1. Good $1\frac{1}{8}$ in.
2. $1\frac{1}{8}$ in.
3. $1\frac{1}{16}$ in.
4. Soft and/or immature.

As a general indication of the guaranteed prices, the differences are for the present as shown in the following examples:—

TOP GRADE.—Strict Good Middling, good colour, good $1\frac{1}{8}$ in. at 9.00d.

AVERAGE GRADE.—Strict Middling, good colour, $1\frac{1}{8}$ in. at 8.25d.

LOW GRADE.—Low Middling, yellow tinged, immature at 6.00d.

Even lower grades have to be accepted, sometimes, but it is impossible to indicate their value owing to the amount of dust, trash and other dirt which they contain.

Ginning Outturn.—The average outturn is:—

LINT	32%
Seed	65%
Waste	3%

but considerable variation occurs, due to the grade and condition of the crop.

Seed Supply.—The strain of cotton seed now in general cultivation is known as "7L1," and is available from the Gatooma Ginnery in two grades:—

Machine delinted (fuzzy) at 10/- per 100 lbs. f.o.r. Gatooma.

If machine planted use about 25 lbs. per acre.

If hand planted use about 15 lbs. per acre.

Acid delinted (free from fuzz) at 22/6 per 100 lbs. f.o.r. Gatooma.

Machine plant about 12 to 15 lbs. per acre.

All enquiries for cotton seed whether for planting or for cattle feed, should be addressed to the Manager, Cotton Ginnery, P.O. Box 124, Gatooma.

It is advisable to order one's seed requirements as early as possible. All cotton seed for planting issued by the Cotton Research and Industry Board is tested for soundness and every precaution is taken to ensure that only the best seed is sent out. For this reason it is always advisable to buy your seed from the Ginnery direct, and not through any other source. On no account should cotton seed that has been bought for Cattle Feed be used for planting. Cases are known where this has been done with disastrous results to the crop, and the grower's finances. It cannot be too strongly emphasised that the use of cheap seed leads to crop failure.

New strains to follow 7L1 are now in various stages of being developed. Some of these are very promising, but 7L1 has been such a good, all round general utility plant that it is going to be difficult to replace it with anything better.

Conclusion.—For those who contemplate cotton growing, the following points are worth repeating.

(1) Prepare land in plenty of time, and secure a good even tilth.

(2) Order your seed well in advance.

(3) Plant shallow and as early as possible within reason—say in November.

(4) Use plenty of seed.

(5) Early thinning and cleaning are both essential.

(6) When in doubt do not hesitate to write and ask for guidance.

Stramonium or Stinkblaar.

A MEDICINAL HERB REQUIRED FOR WAR PURPOSES.

By J. C. F. HOPKINS, D.Sc. (Lond.), A.I.C.T.A.,
Senior Plant Pathologist.

Stramonium, or Thorn Apple, is a common weed which goes under many names. In South Africa it is generally known as Stinkblaar or Thorn Apple, and in the United States as Jimson Weed. It is mostly found growing profusely on sites where decaying organic matter is abundant, such as cattle kraals, old municipal dumps, along roadside drains and so on. The plant is well known to all Rhodesians and was fully described in the "Rhodesia Agricultural Journal" for September, 1941. In the same article, details regarding its properties, cultivation and preparation were also given. The object of this article is to draw attention to the value of the plant and also certain difficulties which must be overcome if commercial quantities are to be marketed. It is used for the relief of asthma and supplies in Britain are short.

Since an article on this subject appeared in *Vuka* (June, 1942) further information has been obtained regarding the commercial requirements of the London market and contact has been made with the Federation of Women's Institutes who have offered to assist in the collection of stramonium and, if necessary, to establish collecting depots in the larger centres. Through the agency of the Farmers' Co-op. Ltd., Salisbury, who have offered to handle the product for export, a firm offer of 7d. per lb. f.o.b. for 5 tons or more of leaf has been received from London, based on samples collected in Salisbury this year and sent Home for analysis. The market report stresses the fact that this price is a good deal higher than obtained in peace time and there will almost certainly be a sharp drop when trade again becomes normal. There is, however, a shortage of stramonium in Britain which will probably last for the duration of the war, and it appears as though the Rhodesian product can help to make up the deficit.

The question therefore arises as to whether it is expedient to start cultivating the plant or to begin by collecting leaves from wild plants. Our knowledge of its cultural requirements is very meagre and there is no guaranteed source of pure seed or assurance of the germinating capacity of any seed which may be obtained; whilst the relation between drug content of the plant and the type of soil on which it is grown is quite unknown in Rhodesia. With all these handicaps to face, cultivation might be a success or a complete failure, and as stramonium grows wild in profusion all over the Colony it would appear that in order to obtain immediate supplies efforts should be concentrated on collection rather than cultivation.

Now there should not be any insuperable difficulties to the collection of the weed. Certain precautions, however, must be observed. In the first place, there are several species and hybrids of Stinkblaar, which are often found growing together but only two are of medicinal value; they are known botanically as *Datura stramonium* and *Datura tatula*. The former has white flowers and the latter mauve, but, unfortunately, an undesirable species, *Datura ferox* also has white flowers, and in some samples received by the Department of Agriculture *D. ferox* has been mixed with *D. tatula*. These two species can be distinguished by their seed pods. Both *D. tatula* and *D. stramonium* have fruits covered with straight slender spines, whereas the spines on the fruits of *D. ferox* are very much thicker, curved and fewer in number. When seen side by side they are very easily distinguishable.

Fig. 1 shows *D. tatula* at the stage when reaping should commence. Its upright habit of growth, spare branching, dark stems and large leaves with pointed lobes should be noted. It can be seen that only one small fruit has developed. Reaping should not be delayed until seed pods are large and numerous. *Datura stramonium* has the same appearance, except that the flowers are white and the stems green.

Fig. 2 depicts a flower of the correct species. The petal tube is long and narrow and almost cylindrical. The pointed lobes of the leaves can be seen clearly

Fig. 3 shows the seed capsule of Stramonium with its delicately tapered, numerous spines by which it is easily distinguished from the wrong species *D. ferox* (Fig. 5)

In Fig. 4 is seen a large plant of *D. ferox*. This species is more common in Matabeleland than in Mashonaland, but is by no means rare in the north. Its spreading, much branched habit of growth and the lighter colour of its leaves and stems contrasts with that of stramonium shown in Fig. 1. The flower of *D. ferox* also differs from that of *D. stramonium*, although both have white petals. The petal tube of the former is relatively short and is much more trumpet shaped than that of the latter. A comparison between Figs. 6 and 2 will illustrate this difference. The more rounded lobes of the leaves of *D. ferox* can also be seen in Fig. 6.

Another plant which is of no medicinal value also grows in company with the Stinkblaar, and a careless collector might gather leaves from it and mix them with stramonium. This useless weed is *Nicandra physaloides*, sometimes known as the false gooseberry or Chinese lantern plant, owing to the shape of its fruits. It has blue flowers which are cup-shaped and wide open at the mouth (Fig. 7), whereas the Daturas have long trumpet-shaped flowers which may curl up during the day-time. The leaves of the false gooseberry are of a paler green than those of stramonium and are less indented on the margins. Stramonium has a very unpleasant smell which is absent from the false gooseberry.

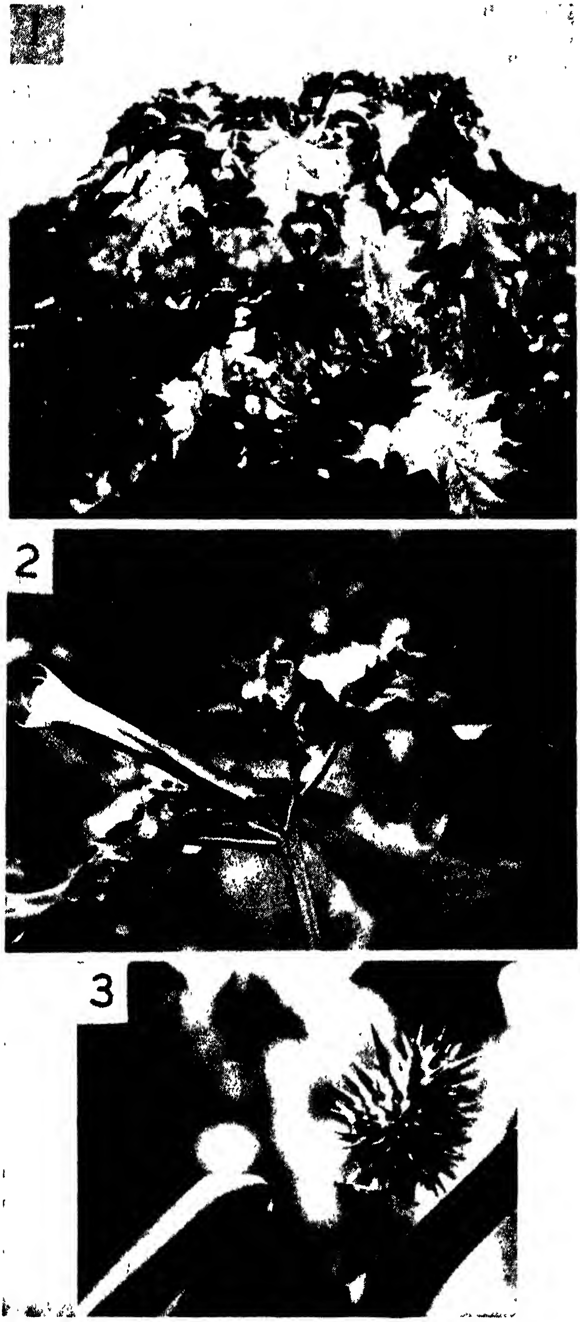
The fruits of the false gooseberry are borne in line on branches and are quite distinct from those of stramonium (Fig. 8), so that there is no excuse for collecting the leaves of this plant if reasonable care is exercised.

The parts of the stramonium weed required are the leaves, without stems, and the young flowering tops. Care should be taken to exclude stem as much as possible because the dried commercial preparation is not acceptable for pharmaceutical purposes if it contains more than 20 per cent. of stem. The drug content of the leaves varies with their age, young ones having a higher percentage than older ones. Furthermore, old leaves are usually affected by a disease causing a light brown spot, which destroys a considerable portion of the surface and gives the prepared sample a brown colour. The finished product should be dull green and the price paid is governed by colour: it is, therefore, important that old leaves should not be gathered. A good way of judging whether a leaf is too old is by the way it comes away from the plant when plucked. If a young leaf is grasped between the forefinger and thumb at the point where the stalk commences and pulled sharply, the blade will break away leaving the stalk attached to the plant. If the leaf is too old, the stalk will break off at the stem and remain attached to the blade. The gathered leaves should be dried as rapidly as possible.

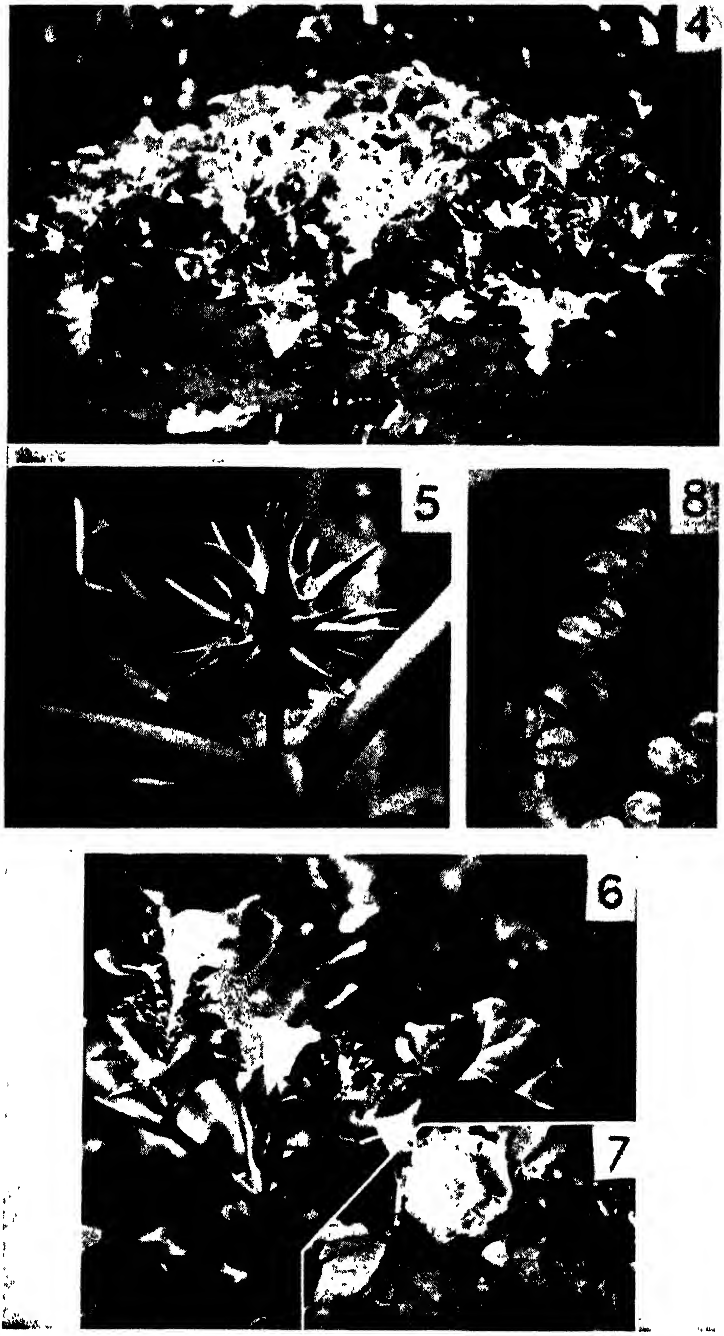
It is recommended by some authorities that they be dried in the shade, but recent information from the Union recommends drying in the sun. The main point is that they must be dried rapidly or else they will turn mouldy. Various ways have been tried, but the best samples have been produced by threading the leaves on a string attached to a stick about 3 or 4 feet long, similar to the method employed for curing Turkish tobacco. The sticks may be hung up in any suitable place such as the roof of a shed, under trees, or preferably dried in a tobacco barn. Good samples of prepared stramonium have been received which were dried by placing them on the ground in the shade of low-growing trees, so that they only receive the early morning and late afternoon sun. Care, however, must be taken to see that no undue amount of dirt, twigs or other leaves get mixed up with the stramonium when it is being gathered up.

Samples sent to Cape Town and London for analysis were collected at the Salisbury Fxperiment Station by the method just described and dried on sticks placed on the rafters beneath a lean-to corrugated iron roof. They were reported on as being of good quality and "very high alkaloidal content." Endeavours must be made to export consignments of similar quality, because the market price quoted was based on these samples.

Leaves and flowering tops are acceptable. Although the leaf stalk should be included, care must be taken to exclude actual stem, otherwise the sample may be rejected. Flowering tops consist of the flowers and young surrounding leaves with their stalks, but again care must be exercised to exclude stem. Fig. 2 shows a flowering top borne at the end of a relatively long stem. The flower and young leaves should be pinched off the stem. The British Pharmacopoeia does not allow more than 20 per cent. of total stem and not more than 1 per cent. of stem wider than 4 m.m. (approx. 5-16th inch). In order to avoid any chance of the rejection of a package after being transported all the way to Britain, collectors should make a special point of eliminating stem.



1. Stramonium (*Datura stramonium* or *D. tatula*) the correct species
2. Flower of stramonium. Note long, narrow petal tube. The colour may be mauve or white.
3. The capsule of stramonium. Note numerous straight, narrow spines; also dark coloured stem of *D. tatula*.



4. *Datura ferox*, the wrong species. Note spreading habit of growth and light colour of stems and leaves.
5. Capsule of *D. ferox*. Note broad based, slightly curved spines. Compare with Fig. 3.
6. Flower of *D. ferox*. Note short relatively broadly trumpet-shape petal tube. The colour is white. Compare with Fig. 2.
7. Flower and leaves of the false gooseberry (*Nicandra physaloides*), the leaves of which must not be gathered with stramonium.
8. Ripe fruits of the false gooseberry.

Grain Storage Bins.

Contributed by the Irrigation Department.

Three designs of grain storage bins are shown in the accompanying drawings Nos. 1712-C and 1717-A.

In normal times the circular bin with a flat reinforced concrete roof would be recommended as the most economical and satisfactory design, but since much of the reinforcing material necessary for its construction is now unobtainable two other designs are shown, in which the amount of steel and wire required has been considerably reduced, especially in that shown in Drawing No. 1717-A, for which only 70 yards of suitable wire is needed.

The details of construction are clearly indicated in the drawings, but a detailed explanation of the more important constructional features is given hereunder.

Building and Reinforcing Walls.—The site selected for the erection of these bins should be a well drained one where a good solid subsoil formation exists.

The foundations and walls must be set out and built in a true circle. Good, sound, well burnt bricks must be used throughout. In the reinforced bins shown in drawing No. 1712-C the brickwork should be laid in a 1:5 cement mortar and all the bricks should be soaked in water immediately before being laid. The mortar joints on the inside of the wall should be neatly struck to give a smooth finish and on the outside the joints should be raked out to a depth of ¾ inch to provide a good key for the plaster

Where reinforcing wire is required the number of turns in each course or section of wall is shown in figures against the various sections.

The inner ring of bricks in each section is laid first. In the 14 inch foundations only one course is laid at a time either as "headers" or "stretchers" according to the bond of that particular course. In the 9 inch wall these courses are laid as "stretchers." When each such ring is completed the specified number of turns of wire are wound round; commencing at the top, half the total number of turns are made in a downward spiral, the remaining number of turns being made in an upward spiral so that the two ends meet and can be joined together. The outer rings of brickwork are then laid in the ordinary way, great care being taken that the joint between the inner and outer rings occupied by the wire is completely filled with mortar which may be poured in as a semi-liquid grout. Each stage of construction is shown in drawing No. 1712-C.

The Damp Course.—An effective damp and ant-proof course is essential and while galvanised iron or damp course felt should be used if available, a substitute may have to be adopted. It is

suggested that for this purpose tar or bitumen such as "Colas" may be warmed and mixed with sufficient sand, which should also be heated, to form a stiff mixture which is applied while still hot to the brickwork at the proper level, in a layer about ⅜ inch thick. The mixture must be allowed to set for two or three days until it is sufficiently hard to permit the building to be continued.

Alternatively the course of brickwork immediately below the damp course level may be replaced by a ring of 1:2:4 concrete 3 inches thick, the surface of which should be coated with tar or bitumen before further bricks are laid.

The Floor.—An essential precaution in building any of these bins is to ensure that the floor shall be impervious to moisture and termites, it is strongly recommended that the joint between the floor and walls should be sealed with bitumen in the following manner.

Before the concrete floor is laid the inside of the foundations should be plastered with 1:4 cement plaster to a depth of 8 inches below the damp course. The concrete floor is then laid with its rim slightly above the damp course, and as the concrete is laid a V-shaped groove about 1½ inches wide and of the same depth must be formed between the floor and the plastered surface of the foundations. When the concrete is dry a quantity of bitumen, which is normally solid at ordinary temperatures, is melted, preferably in a container surrounded by boiling water, and poured into the groove, which should be completely filled. In the event of the floor shrinking or subsiding the bitumen will yield sufficiently to maintain a waterproof joint, whereas otherwise a crack would develop. In order to ensure that the bitumen adheres to the concrete before it solidifies it is advisable to warm the surface of the Vee groove with the flame of a blow lamp as the bitumen is poured and the bitumen itself may be kept warm with the blow lamp for a few moments as it flows along the groove

It may prove difficult to determine when the bin is thoroughly dry, and as an added precaution against dampness rising from the concrete floor it is suggested that it should be given some impervious covering. A material such as damp-proof felt, "Malthoid," or other similar floor covering should prove suitable, but failing one of these a bituminous mixture similar to that suggested for the damp course spread in a ¼ inch or ½ inch layer over the entire floor should prove equally effective.

Plastering.—In the case of the flat topped bin some question arises as to whether the walls should be plastered internally or externally, since there are advantages and disadvantages in both methods of construction. In the blue prints previously issued by this Department these bins are shown plastered on the inside, but it is now considered that the advantages of external plastering predominate, and in all cases this alternative is recommended.

The brickwork should be allowed to dry out as long as possible before the plaster is applied. When plastering the surface of the brickwork should be moistened sufficiently to ensure the proper adhesion of the plaster. The plaster should be mixed in the proportion of one part cement to four parts of clean sharp

river sand. When circumstances permit the plaster should be kept damp for a few days to prevent the development of fine cracks. When dry the plaster may be given two thin coats of limewash which will render it more waterproof and will tend to keep the bin cooler and maintain a more even temperature. An external application of limewash is also recommended in the case of bins which have already been plastered internally.

It should be noted that when plastering the sloping roof of the conical bin the plaster should be sufficiently thick to cover the projecting corners of the bricks to a depth of ½ inch.

Filling.—It must be very clearly understood that the bin must be thoroughly dry throughout before being filled. The outlet pipe and the manhole should both be left open to allow as much draught as possible to pass through the bin. The process might be hastened by lowering buckets filled with burning wood or charcoal into the interior, but one must not be deceived by the superficial dryness which such a procedure might induce.

It is equally important that the maize should not contain more than 12½ per cent. moisture when placed in the bin

Caution.—When the maize has been in storage for some little time it is probable that the atmosphere within the bin will contain a fairly high percentage of carbon dioxide, and great care must be exercised to see that the bin has been sufficiently ventilated before anyone enters it.

Special Notes on the Construction of the Circular Semi-reinforced Brick Bin. (Drawing No. 1717-A).—This design has been introduced solely to meet the needs of those who, in the present difficult circumstances, are unable to obtain the requisite amount of reinforcing wire to construct either of the bins shown in drawing No. 1712-C. Actually this structure is not theoretically sound, but if constructed strictly in accordance with the following recommendations there is little doubt that it will prove entirely satisfactory in practice.

The quantity of wire required to reinforce the walls has been reduced to a minimum and the stability of the structure depends largely on the strength of the brickwork only. It is therefore of the greatest importance that only hard, sound, uncracked bricks should be used in its construction They must be thoroughly soaked in water immediately before being laid. Cement mortar mixed in the proportion of one part cement to four parts of clean, sharp river sand, must be used throughout and great care must be taken to see that each course is properly bonded and that the vertical joints are evenly staggered. The top three courses of the vertical wall must be reinforced with six strands of wire to withstand the outward thrust of the conical roof.

On completion the bin must be allowed to dry for at least six weeks before being filled to ensure that the brickwork attains the required strength, but it is probable that a still longer period will elapse before the structure is thoroughly dry and can be filled without fear of the grain being spoilt by dampness.

Testing for Dryness.—Since it is of such great importance that these bins should be thoroughly dry before being filled, it is

recommended that they should be built in the dry season, at least six weeks before the rains may be expected.

The following procedure is suggested, as a rough and ready test to indicate if the bin is dry.

When the bin appears to be dry, probably six weeks after completion, a few pieces of ordinary dry newspaper should be hung in the bin at various heights on the wall. The bin should then be sealed up for 24 hours. If, at the end of this period, the paper is found to be in the least soft or clammy, the bin should be ventilated for a further period of a few days, and the test repeated. When the paper remains dry and brittle after being sealed up in the bin for two or three days, it may be assumed that the bin is sufficiently dry.

An alternative indicator which might be used at the same time is common salt. The salt, after being thoroughly dried and powdered, should be placed in two or three open containers at different levels in the bin, and the tests made as previously described in the case of paper. The salt will tend to cake if any excessive moisture is present.

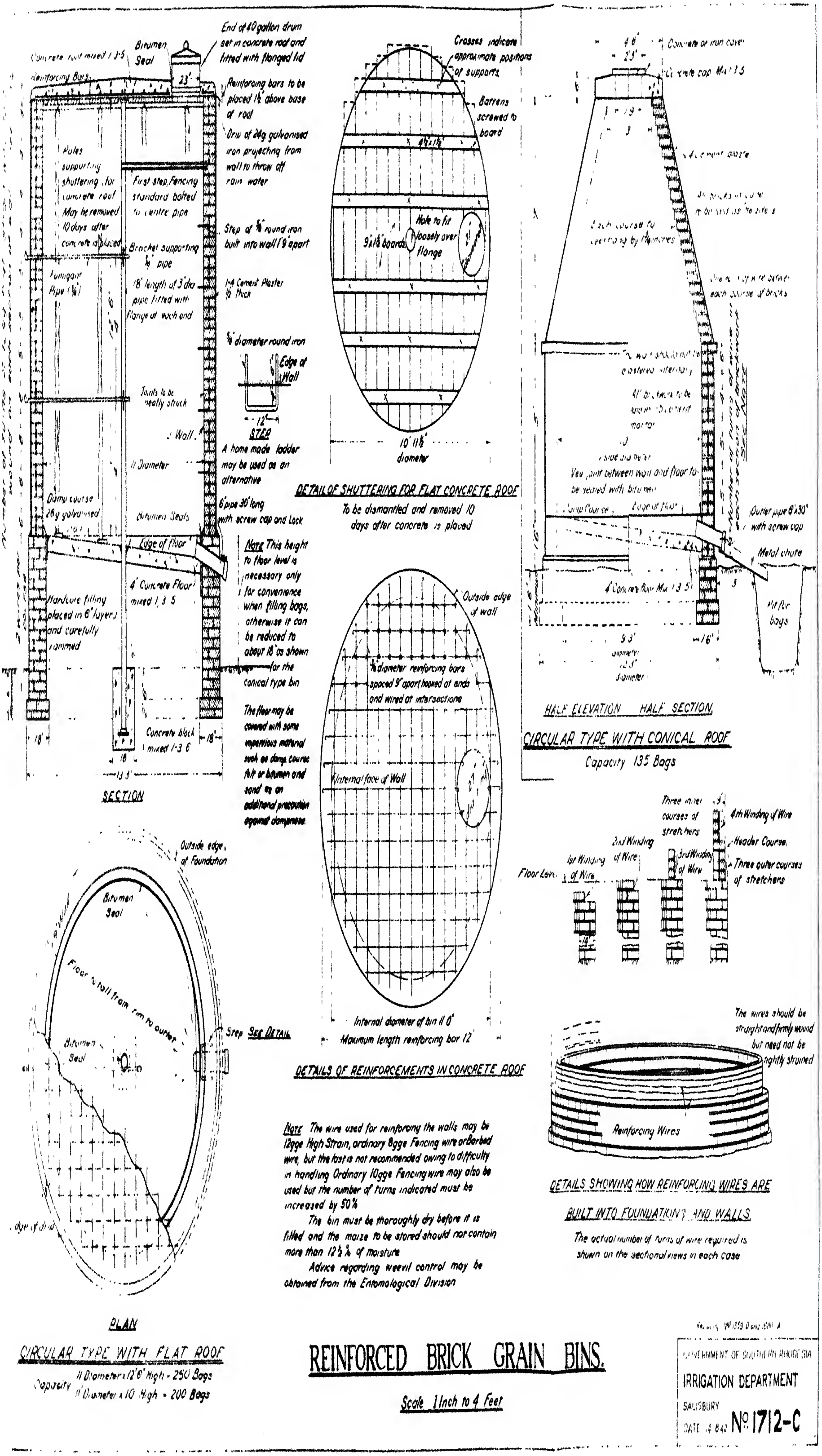
SCHEDULE OF QUANTITIES. GRAIN BINS.

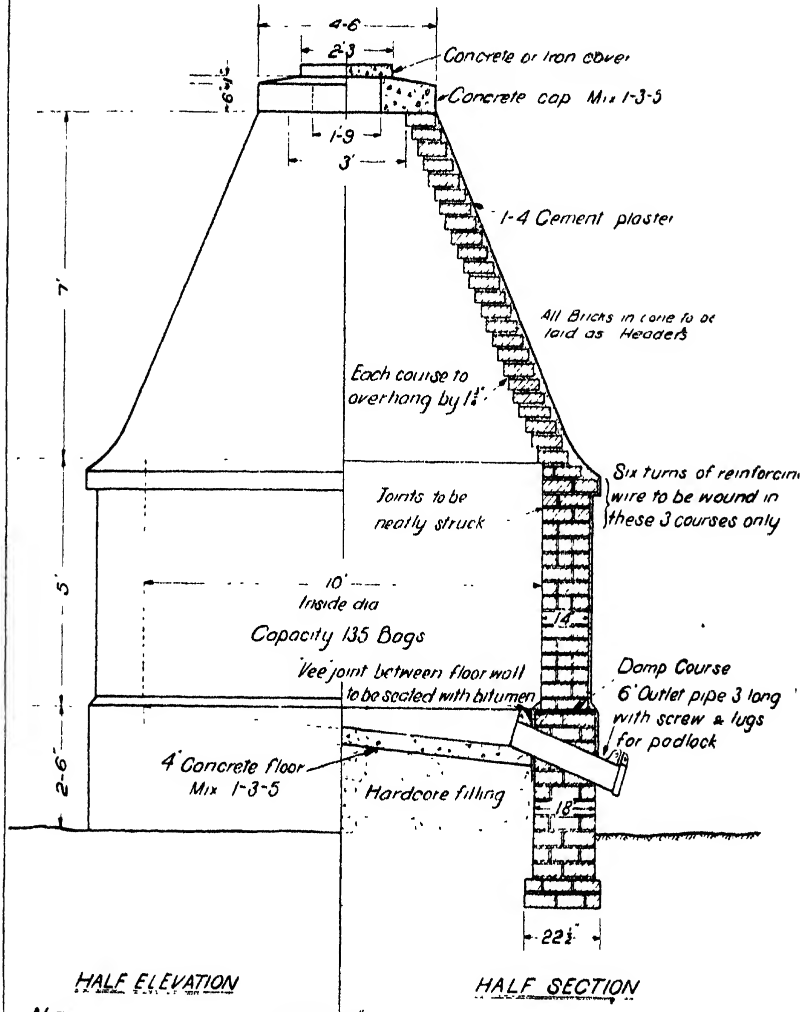
Circular Type with Flat Roof. Drawing No. 1712-C.
Capacity: 250 Bags.

Item.		Quantity.	
Brickwork	Bricks	6,500	
	Cement	25	pockets
	Sand	5	cu. yds.
Concrete floor and roof	Cement	17	pockets
	Sand	2	cu. yds.
	Stone	3½	cu. yds.
Plaster	Cement	7	pockets
	Sand	1	cu. yd.
Reinforcing wire	For foundations	400	yds.
	For walls	700	yds.
Reinforcing iron for concrete roof, ⅜ inch diameter		310	feet
Centre pipe	3"x18' with two flanges	1	length
Outlet pipe as shown		1	
Steps	⅝" diameter iron	14	feet.
Fumigant pipes	¾"x7' with elbow and plug.	2	
Bitumen for sealing floor		30	lbs.
Damp course and floor covering		As required	

For a bin 10 feet high having a capacity of 200 bags the above quantities will be reduced by the following amounts:—

Bricks 850. Cement 3½ pockets. Wire 175 yards.


REINFORCED BRICK GRAIN BINS.
Scale 1 Inch to 4 Feet
SECTION
PLAN
CIRCULAR TYPE WITH FLAT ROOF
Capacity 11 Diameter x 12'6" High - 250 Bags
11 Diameter x 10 High - 200 Bags
End of 40 gallon drum set in concrete roof and fitted with flanged lid
Bitumen Seal
Reinforcing bars to be placed 1½" above base of roof
Drip of 24g galvanised iron projecting from wall to throw off rain water
Poles supporting shuttering for concrete roof May be removed 10 days after concrete is placed
First step, Fencing standard bolted to centre pipe
Step of ⅝" round iron built into wall 1'9" apart
Bracket supporting ¾" pipe
Fumigant Pipe (¾")
18' length of 3" dia pipe fitted with flange at each end
1-4 Cement Plaster ½" Thick
⅝" diameter round iron
Edge of Wall
STEP
A home made ladder may be used as an alternative
Joints to be neatly struck
Damp course 26g galvanised
Bitumen Seals
6" pipe 30" long with screw cap and Lock
Edge of floor
4" Concrete Floor mixed 1, 3, 5
Hardcore filling placed in 6" layers and carefully rammed
Concrete block mixed 1-3-6
Note This height to floor level is necessary only for convenience when filling bags, otherwise it can be reduced to about 18" as shown for the conical type bin
The floor may be covered with some impervious material such as damp course felt or bitumen and sand as an additional precaution against dampness.
Crosses indicate approximate positions of supports
Battens screwed to board
Hole to fit loosely over flange
10' 11½" diameter
DETAIL OF SHUTTERING FOR FLAT CONCRETE ROOF
To be dismantled and removed 10 days after concrete is placed
Outside edge of wall
⅜" diameter reinforcing bars spaced 9" apart hooked at ends and wired at intersections
Internal face of Wall
Internal diameter of bin 11' 0"
Maximum length reinforcing bar 12'
DETAILS OF REINFORCEMENTS IN CONCRETE ROOF
Outside edge of Foundation
Floor to fall from rim to outlet
Step SEE DETAIL
Note The wire used for reinforcing the walls may be 12gge High Strain, ordinary 8gge Fencing wire or Barbed wire, but the last is not recommended owing to difficulty in handling. Ordinary 10gge Fencing wire may also be used but the number of turns indicated must be increased by 50%
The bin must be thoroughly dry before it is filled and the maize to be stored should not contain more than 12½% of moisture
Advice regarding weevil control may be obtained from the Entomological Division
Concrete cap
Outlet pipe 6"x30" with screw cap
Metal chute
Pit for bags
4" Concrete floor Mix 1 3 5
HALF ELEVATION HALF SECTION
CIRCULAR TYPE WITH CONICAL ROOF
Capacity 135 Bags
Three inner courses of stretchers
4th Winding of Wire
Header Course
Three outer courses of stretchers
3rd Winding of Wire
2nd Winding of Wire
1st Winding of Wire
Floor Level
The wires should be straight and firmly wound but need not be tightly strained
Reinforcing Wires
DETAILS SHOWING HOW REINFORCING WIRES ARE BUILT INTO FOUNDATIONS AND WALLS
The actual number of turns of wire required is shown on the sectional views in each case
GOVERNMENT OF SOUTHERN RHODESIA
IRRIGATION DEPARTMENT
SALISBURY
No 1712-C



Scale: 1"-4

NOTE

BRICKWORK

The stability of this bin is dependent on the strength of the brickwork alone and it is essential therefore that all the bricks must be hard, sound and uncracked. They must be thoroughly soaked in water immediately before being laid. They must be laid in 1-4 cement mortar and correctly bonded so that the vertical joints are evenly staggered.

DAMP COURSE

If suitable metal or felt is unobtainable the damp course may consist of a ⅛" layer of tar or bitumen and sand applied hot, or the top course of the 18" foundations may be replaced by a ring of concrete 3" thick.

REINFORCEMENT

The top 3 courses of the vertical 14" wall only are reinforced with 6 turns of wire. The wire used may be 12½ Gge High strain, ordinary 8 Gge fencing wire or barbed wire.

The bin must be allowed to dry for at least 6 weeks before it is filled to ensure that the brickwork attains adequate strength. A longer period may be found necessary to ensure the complete dryness essential for the safe storage of the grain.

CIRCULAR SEMI-REINFORCED BRICK GRAIN BIN.

No. 1717. A.

Circular Reinforced Bin with Conical Roof. Drawing No. 1712-C
Capacity: 135 Bags.

Item.		Quantity.
Brickwork	Bricks	1,300
	Cement	18 pockets
	Sand	3½ cu. yds.
Concrete floor and roof cap	Cement	6 pockets
	Sand	¾ cu. yds.
	Stone	1¼ cu. yds.
Plaster	Cement	8 pockets
	Sand	1¼ cu. yds.
Bitumen for sealing floor		25 lbs.
Reinforcing wire		450 yds.
Outlet pipe as shown		1
Damp course and floor covering		As required

Circular Semi-reinforced Bin with Conical Roof Drawing No. 1717-A Capacity: 135 bags.

Item		Quantity.
Brickwork	Bricks	6,500
	Cement	30 pockets
	Sand	1½ cu. yds
Concrete floor and roof cap	Cement	6 pockets
	Sand	¾ cu. yds.
	Stone	1¼ cu. yds
Plaster	Cement	8 pockets
	Sand	1¼ cu. yds
Bitumen for sealing floor		25 lbs
Reinforcing wire		70 yds.
Outlet pipe as shown		1
Damp course and floor covering		As required.

Poultry Parasites.

By H. G. Wheeldon, Poultry Officer.

It appears from a survey of the disorders affecting poultry that the effects of poultry parasites, internal and external, are very marked and should not be overlooked by poultry producers. These parasites are responsible for debility and unthriftiness generally, which are followed by low productivity among adult fowls, and, although not always producing fatal results, they are likely to result in financial loss. Young growing stock are more seriously affected, as, with undermined constitution and their growth retarded, there is usually considerable delay in reaching laying maturity or economical growing as table birds.

Although internal parasites are much less troublesome in Rhodesia than in many other countries, the extent to which they do exist in some cases is not surprising. It is generally considered advisable when poultry are found to be unthrifty for no apparent reason, to first ascertain the condition of the stock and whether they are affected externally or internally by parasites

The group known as external parasites, such as lice, of which there are several types, thrive upon the skin surface under the feathers; others visit their host only for food, such as fowl ticks and some mites. Internal parasites on the other hand are those which exist within the body of the bird, as for example intestinal worms. The intestinal tract, gizzard and other internal organs may become infested. Those affecting the intestinal tract are the most common, and serious results follow when large numbers occur. These parasites are commonly referred to as round or tape worms. Other internal parasites such as gape worms are not generally found in Rhodesia.

Intestinal worms may be present in the majority of flocks without obvious harmful effects, but the possibility of their increasing must of necessity be considered, for if the conditions become favourable, mild cases may develop into serious infestations.

Cleanliness in the houses, yards and surroundings is the watchword and should be strictly observed at all times in the management. Sunlight is the best natural germicide we have; runs exposed to the sun, and dry, well-ventilated houses minimise the propagation of internal parasites. Dark houses without ventilation, or untidy runs that may be wholly overshadowed by trees, and damp, with an accumulation of filth and possibly pools of water during the rains, form ideal conditions for poultry parasites of all descriptions. It is generally observed when poultry are kept under such conditions they prove to be unthrifty and unprofitable. A naturally well-drained site is important, the

runs should be partly shaded and kept clean and tidy, and any holes which collect water during the rains should be filled in. The use of alternative runs is always desirable.

The intention of this article is to deal with parasites which are common in Rhodesia. The gape worm, for example, which causes gapes in chickens, is unknown in this Colony, but in countries with humid atmospheric conditions, and where earth worms, the host of the gape worms, are plentiful, it is very common and causes heavy mortality. This also applies to other parasites not of importance in this Colony.

Internal Parasites.—These are usually found in the intestinal tract and for ordinary purposes they may be classified into two groups, namely, (1) Round worms, (2) the Ribbon, segmented or tape worm.

The control of intestinal parasites and treatment of infested stock should be directed respectively to sanitation in the houses and runs, dosing the stock to expel the worms, and destroying them to prevent re-infesting the flock. Clean out the houses and runs thoroughly and burn all refuse. Spray the floors of houses with a hot solution of disinfectant, and apply quicklime to the surface of the runs, this should destroy the eggs and worms with which it comes in contact. The utensils should at all times be kept clean, and so arranged as to prevent the stock from stepping into the mash hoppers and water vessels.

Termites are regarded as a host of intestinal worms, and ant heaps near the pens should be destroyed, if possible, on poultry plants where the recurrance of infestation takes place.

Where it is customary to feed termites to poultry, the mounds chosen for this purpose should be some distance away from the site of the pens; these would be less likely to transmit infestation. Worms infest fowls, waterfowl, turkeys and pigeons.

Infested birds are unthrifty and droopy, the plumage is dull in appearance and ruffled, with derangement of the digestive system. Young stock are stunted in growth, and the commencement of egg laying is delayed several months. There is also loss of egg production from adult stock, followed by loss of weight, emaciation, weakness of the legs and mortality. With heavy infestation the birds are lighter than normal and the watery droppings may contain worm eggs, or the segments of tape worms.

(1) **Round Worms.**—Are the most common of internal parasites, and of these there are several kinds affecting the internal organs, chiefly the intestines.

Round worms vary in length and are cylindrical in shape tapering at both ends. When numerous they may seriously interfere with the digestion and cause mal-nutrition. In some cases persistent diarrhoea is observed, and in others infection has been known wholly to obstruct the intestinal passage. Reproduction takes place by the production of a large number of eggs in the bowels of affected stock. These eggs pass out in the droppings, and under certain conditions may contaminate the food or drinking water. Under favourable damp conditions the eggs of

these worms will survive for several months in the soil and become a source of infection to the flock. In sunlight worm eggs survive only a few hours, in shady, dry areas they may survive for two or three weeks. Infection takes place when the eggs gain access to healthy stock either in drinking water, in the food, or on consuming infected intermediate hosts such as flies, grasshoppers, earthworms and termites. The development of adult worms from newly hatched larvae after entering the alimentary-canal takes approximately three weeks.

Treatment.—Several remedies have been advised as a flock treatment, from time to time, for the eradication of these parasites, given with water or mixed with mash, after withholding food for twenty-four hours before treatment, but they are not as a rule entirely satisfactory. The individual treatment of birds, as distinct from flock treatment, will be amply repaid. Flock treatment is generally unsatisfactory because many of the affected birds may be off their feed which is a common symptom of affected stock. Such birds escape effective treatment, and those which are not so affected may consume more than is required.

(a) Good results are obtained by dosing individual birds with carbon tetrachloride. The drug is given first thing in the morning, after overnight starvation, and omitting the previous evening's food. The following doses are recommended. Birds six months and older 2.c.cm., 4 to 6 months 1½ c.cm., 2 to 4 months 1 c.cm., under 2 months ½ to ¾ c.cm. It is seldom necessary to treat chickens under 5 weeks of age. The drug may be given in capsule form, but a much cheaper method is to give the liquid, either pure or mixed in a teaspoonful of milk or liquid paraffin. A safe and quick method is to administer by means of a syringe and piece of thin rubber tubing about 4 inches long, the latter inserted through the mouth into the gullet. This remedy will remove every worm, and it is safe and does not adversely affect production. The birds should always be caught and handled carefully.

(b) Take 1½ lbs. of finely chopped Rhodesian tobacco stems or 1 lb. tobacco with nicotine content about 5 per cent. soak in hot water for two hours and mix with 8 lbs. of mash. This is sufficient for 100 adult birds. Tobacco with low nicotine content would be less effective, and the quantity of tobacco used in the mash is limited by its palatability; the birds would not consume the mash if it were unpalatable to them.

Feed this mixture twice with an interval of three days, given in the early morning on an empty crop. After two hours give drinking water containing Epsom salts (1 oz. to 1 gallon of drinking water). Feed as usual during the afternoon.

It is advisable to confine the birds to houses with cement floors during the treatment, or preferably on wire floors, to facilitate the control, and destruction of the worms voided. The houses should then be thoroughly cleaned, and it is necessary to change the birds to fresh runs. The surface of the runs which have been occupied by infected birds should be loosened, quicklime applied and raked in. Such runs would be treated more conveniently in the rainy season, or, must be well watered to thoroughly saturate the lime and soil. They should remain vacant

for about three months. During this period runs could be planted with a cereal crop such as barley and oats, or sunflower for green food would help to sweeten the soil.

(2) **Tape Worms.**—These vary in size and may be several inches in length. They are flat and segmented the full length. Tape worms attach themselves to the walls of the intestines and are more difficult to remove than round worms. Numerous different kinds have been reported as affecting poultry, but all of them attach themselves with head embedded in the inner lining of the bowels, their bodies suspended. They cause irritation of the bowels and mal-nutrition. The posterior or ripe segments containing a large number of eggs are voided in the droppings and must pass part of their existence in an intermediate host, such as ants and beetles. The grasshopper is a host of a tape worm affecting turkeys. When a host containing the embryo is swallowed by a fowl a larva or young worm is liberated and attaches itself to the wall of the intestine and there develops into a mature tape worm. The general remarks on round worms apply also to tape worms.

Treatment.—The treatment for tape worms is more difficult than for round worms, and further investigation is necessary for their complete removal, especially the heads of the worms, but treatment is effective in the removal of a large number of segments of the worms.

(a) Administer carbon tetrachloride as recommended for the treatment for round worms

(b) For adult stock give 10 drops of spirits of turpentine in a dough pill or teaspoonful of sweet or olive oil. In the case of young growing stock the dose should be reduced according to age. The stock should be starved for twenty-four hours with the exception of drinking water, this should be withheld only during the morning before treatment is administered. About three hours after dosing give Epsom salts in the drinking water, 1 oz. to 1 gallon of water, to the flock. Give a light feed of grain in the evening, and the usual feeding restored to them the next day.

External Parasites.—The parasites of birds known as external parasites may be conveniently classified into the following groups, namely, ticks, mites, lice and fleas Some of these live in the roosts and nest boxes, or floors of poultry houses, such as fowl ticks, mites and fleas, and others pass their whole existence on the bodies of birds, such as lice and some mites, which live on the feathers and secretion of the skin. The effect of external parasites on adult stock, although detrimental, is not as severe as in the case of young stock

Turkeys, pigeons and canaries are all subject to infestation by lice peculiar to themselves and all of which can be controlled by reasonable care and attention. Of the precautions desirable for the control of parasites of domestic birds, it should be emphasised that care is necessary to avoid their introduction to clean yards such as by stock, crates and second-hand appliances which are likely to transmit infestation.

Fowl Tick (Argus persicus).—This tick erroneously referred to as the "tampan," is undoubtedly the worst of the external

parasites the farmer has to guard against, and is probably accountable for greater mortality and loss to the industry than any other parasitic vermin. The fowl tick is unfortunately widely distributed throughout South Africa as in other hot countries. It is found in poultry houses and under the rough bark of trees where poultry roost at night. It is more commonly associated with fowls, but will subsist on ducks, geese, turkeys and pigeons under favourable circumstances. It transmits a disease called Spirochaetosis, which often proves fatal to poultry.

Method of Detection.—Poultry farmers are sometimes quite unaware of the presence of fowl ticks on the premises until they become numerous. Poultry on being attacked by this pest, show the following symptoms: Anaemic, with pale face and comb; they are listless with drooping wings, diarrhoea, and are easily caught. The flock lays few, if any eggs; some birds become semi-paralysed, usually lying on one side kicking their outstretched legs. This semi-paralysis might be the first symptom observed on introducing a few poultry to heavily infested houses, and especially when subjected to this pest for the first time under such circumstances they sicken rapidly overnight.

Flocks which are exposed to constant but milder attacks are more resistant, but heavy economic losses may be sustained as the pest increases numerically in proportion to the size of the flock, and although the birds survive temporarily during that period their appearance is generally unthrifty and the productive returns from them definitely unprofitable.

On examining the houses small dark specks resembling ink spots may be detected at the edge of cracks in the perches, and overlapping woodwork, on the nest boxes, and, when numerous, in crevices in the walls of the houses. When this is observed the presence of fowl ticks is practically certain. The blade of a knife or similar instrument should be inserted into and dragged along cracks or crevices in the vicinity of the roosts, and if on removal it is stained with blood, a more detailed examination may definitely reveal the presence of engorged adult ticks. They feed only at night, taking refuge during the day, thus resembling the common bed bug, but they may be observed after dark moving about on the walls of the house and perches or feeding attached to the feet and body of the birds. It is usual in tick-infested premises, also, to find the engorged larvae or small ticks the size of a pinhead attached to the fowls under the wings.

Appearance and Life Cycle.—The adult fowl tick is oval in shape, flattish and slightly tapering towards the head, and has eight legs. The dorsal surface of the body extends over the head forming a shield. The colour when disengorged is light brown, withered in appearance, and when engorged they become darker, almost dark slate in colour, with indentations on the back or dorsal surface.

The female lays a large number of eggs as a rule, in protected places, such as in cracks or crevices inside poultry houses in close proximity to the roosts. The incubation period is about three weeks, and the larvae at first are transparent to the naked eye, round in shape and having six legs. They immediately search for a host, then become translucent, and later, as they become fully

engorged, the colour changes to dark grey, and in size and shape they resemble the head of a pin. The larval stage is spent attached to the fowl day and night, usually under the wings, for approximately ten days, engorging themselves. It is during this period they are transported from one locality to another on infested poultry, and thus become widely spread throughout the country. As they become fully engorged they leave their host and assume the habits of adult ticks, hiding during the day and coming out to feed at night. They pass through the nymphal stages when the number of legs increases to eight, and finally develop into adult ticks. The life cycle from the egg stage covers a period of several months.

The fowl tick may exist for a long period without the presence of poultry and it has been known to live for two or three years apparently without a host, and in a sealed test tube for about a year. As the result of this resistance birds on being placed in poultry houses that were known to be infested and remained vacant for two or three years, have sickened in a day or two, much to the surprise of the owner.

It is imperative that poultry farmers should exercise reasonable vigilence at all times so as to avoid introducing this pest to the farms. They may be transported by tick-infested fowls and crates removed from premises that are infested, including the poultry from native hawkers.

Elimination of Fowl Ticks.—It is very important primarily to guard against the introduction of this pest, and, if already established, to act promptly with a view to its destruction. Fowl ticks when present are a constant menace to the poultry farmer, and their elimination must be tackled without delay because it means financial loss; certainly the difference between profit and loss.

All new birds on arrival on the farm should be scrutinised or, in the event of any doubt, individual birds should be dipped and isolated for ten days, before placing the stock in their permanent houses; isolated preferably in temporary quarters which can be burned. This practice would minimise the possible introduction of the fowl tick to uninfested premises.

Poultry houses should be constructed with a view to controlling insect vermin: that is, smooth walls internally, and all fittings and utensils detachable. An annual application of wood preservative and insecticide to all woodwork is recommended. Alternatively, the perches and other fittings could be immersed on occasions in a cattle dipping tank for the destruction of insect vermin.

In dealing with infested houses which are of a permanent nature perseverance and patience are necessary. Tick-infested fittings should be burned. A great deal depends on the vigilance and thoroughness with which any measures for eradication are carried out.

For brick houses and houses constructed of corrugated iron containing woodwork which are valuable, spraying with boiling water under pressure or the use of a plumber's blow lamp are recommended. Direct the flame or water into all crevices and overlapping joints, or spraying with a strong insecticidal solution.

A suitable solution is 8 ozs. chloride of lime to 1 gallon of water. When spraying an ordinary stirrup or orchard pump, which will exert a good force and which has an adjustable nozzle, is suitable. The more force that can be used the better to drive the spray into all crevices and overlapping parts in the houses. Spraying should be repeated at least three times at intervals of five days, and then a most careful examination made from time to time to detect the presence or otherwise of the pest.

Fill up cracks and crevices with hot tar or other wood preservative, and the latter should be used also for treating joints in timber and painting the perches. Plaster all walls thoroughly and whitewash. After a thorough renovation as suggested, vermin-proof perches might be considered, but it is advisable also to hang one or two pieces of plank on the walls in proximity to the perches. These serve as traps behind which the ticks will hide during the day, when they can be conveniently collected and destroyed at regular intervals.

Eradication is generally easy, but offers great practical difficulties on some farms, especially the destruction of the last tick or last few parasites.

Treatment.- The treatment of affected birds consists of isolation in clean quarters after removing the attached larvae by dipping. Feeding on bread soaked in milk, or moist mash, and giving a tonic (Easton's Syrup or Parrish's Food) in the drinking water will restore to normal health individual birds not seriously affected.

Dipping is carried out by submerging the body and lower part of the neck of the bird in a solution of Jeyes' or Kerol, 3 to 4 tablespoonful to 4 gallons of warm water, saturating the feathers to the skin, and before releasing the bird saturate the feathers of the head and upper part of the neck.

The Tampan (Ornithodorus muobata).--Although a tick, it does not resemble the fowl tick, being round and full. The colour is darker brown than the fowl tick and the dorsal surface contains several elongated indentations radiating towards the sides which are characteristic of the tampan. It is not nearly so widely distributed as the fowl tick in South Africa.

Red Mite.—This is generally known as the tropical Red Mite of poultry and is a serious pest throughout South Africa. As the name implies, this parasite is very small, almost transparent on hatching, but changing to bright red in colour as it becomes engorged with blood, when they can be easily observed, afterwards changing to brown as the adult stage is reached.

This mite often occurs in countless numbers and is intensely irritating to bird life. They frequent poultry houses and pigeon lofts attacking their host at night, and are usually more active during the warm weather. Their presence may first be suspected by general unthriftiness and restlessness of the flock. Young pigeons may be found dead in the nest or chickens under broody hens without any apparent reason; it is not unusual to observe pigeons stamping their feet and generally restless after alighting on their loft or as they stand in close proximity to their nests. Their presence may be detected by what appears to be a red line

emerging from cracks or on the hoppers, roots and other parts of poultry houses. The lines on closer examination reveal thousands of these moving mites forming an unbroken red line, or are seen on the stock and they may be felt swarming as small dark moving bodies on the attendant's hands from nest boxes or the perches or other fittings on being handled. They hide in clusters under the perches and undisturbed boxes, or other utensils, also in overlapping wood, in crevices and in any neglected material lying about the houses.

This mite saps the vitality of the stock by swarming on them to feed, causing considerable irritation and restlessness at night on the roost, so much so that poultry will abandon infested houses. It is often difficult to induce poultry to occupy infested houses, and they will rather resort to trees or fencing posts to roost. Sitting hens will leave their nests pale and anaemic and pigeons will desert their loft.

It is a persistent pest in neglected poultry coops and houses, and one of the most irritating to both poultry and attendant.

A general lack of tidiness and cleanliness in runs, houses and utensils, or otherwise negligence of the plant or loft, are favourable to their propagation.

Treatment.—A thorough clean-up and renovation of the premises is required, and all wooden utensils, perches and nest boxes painted with solignum or carbolineum, metal containers should be treated with boiling water or antiseptic solution. Cleanliness and ordinary care will serve to eliminate this pest. Sitting hens and pigeons should be dusted with insect powder before settling them down, and repeat again soon after hatching. In the case of pigeon lofts, the nesting apartments or racks should be thoroughly cleansed after the removal of each set of squabs.

Lice.—The louse family consists of many types, all of which spend their existence on the bodies of birds, they only leave accidentally. They can generally be controlled by the birds themselves under natural conditions, but under certain circumstances individual birds may become overrun with lice, or lousy, if not given attention. The effect of lice when numerous is quite noticeable, even in the case of healthy vigorous birds.

According to their habits they may be divided into three groups:—

(1) *The Head Louse* is usually found on the head and neck of chickens and adult fowls, attached to the small feathers on the crown of the head, around the eyes and under the beak. It is grey in colour and not very common in Rhodesia. It remains close to the skin, the eggs being deposited at the base of small feathers. In some countries it is responsible for much mortality. The application of mercurial ointment, carbolic ointment or paraffin and lard to affected parts is recommended for the destruction of this louse.

(2) *The Body Louse* infests the bodies of birds. They are usually found under the neck hackle, under the wings and vent feathers. They vary in size, are generally light or straw coloured, and are probably the most common of all lice. On turning up the feathers they will be observed moving quickly over the skin of the

bird or at the base of the feathers, so quickly they cannot easily be caught. These lice sometimes become attached to the hands when handling birds and are found later crawling up the arms and neck. The eggs are deposited in large numbers in matted clusters attached to the base of the feathers. Poultry are never actually free of this parasite, but they are probably the least harmful, except when very numerous, as they can be kept under control by their host. The natural means of poultry to free themselves and control this pest is by dust bathing or wallowing in loose moist earth. A site should be provided in the pens in the shade of trees for this purpose, keeping the earth moist and loose. It is not necessary to incorporate with the soil ashes, sulphur or other preparations. The stock prefer clean moist earth, but under circumstances where they cannot have access to a dust-bath, for example, when isolated in cages, the most suitable precaution is to insect powder the birds. This species multiplies at an alarming rate and has a depressing and irritating effect on the stock. In bad cases the feathers with clusters of eggs should be cut off and burned, individual birds should be dusted well under the feathers with sodium flouride or other insect powder; twice at intervals of 10 days should serve to eradicate this louse.

(3) *The Depluming Mite* lives chiefly on the feathers of birds located as a rule at the base of quill feathers on the head, neck and rump. Affected feathers may fall out or may be plucked out by the bird due to the irritation. This must not be confused with feather eating although it might be the predisposing cause. This mite is long in the body with a large head and has biting habits; it is grey or dark in colour and fairly small. It destroys the floss and other soft parts of the feathers giving the infected bird a ragged or worn appearance. Individual treatment must be carried out by insect powdering the birds with sodium flouride at intervals of a few days until the mite has disappeared, otherwise dipping the birds will be necessary—two tablespoonful of Kerol or Joyes' Fluid to 4 gallons of water is sufficient for this purpose. The dipping of laying birds is undesirable.

Scaly Legs: The Leg Scabies Mite causes scaly leg and is widely distributed in South Africa and elsewhere. It is prevalent mostly in yards where supervision is not strictly observed and unsanitary conditions favour its spread. This mite confines itself to the shanks of birds, burrows under the scales, causing irritation which results in the secretion of a fluid; this dries forming a light coloured crust first in patches, and, if neglected, spreads over the whole surface of the shank, followed by intense irritation of the legs and toes. Affected birds are observed pecking at the scales for relief and, as the mites are protected by the crusts or scabs they continue their torture incessantly and finally the affected birds are unable to walk without difficulty. From this it will be fully realised that such a condition undermines the health and vigour of birds, resulting in unproductiveness and financial loss. The removal of pieces of scab by the birds may release some of the parasites which will survive on the perches and in the nesting material for a few weeks, exposing the whole flock to infestation. Neligence and unsanitary conditions facilitate spread from bird to bird.

Like other parasites this mite is transferred from one bird to another by contact and chiefly from infested perches and utensils thus for preventing the spread of this parasite prompt measures are necessary with a view to its eradication. The infested stock and the roosts must receive attention. Old stock that are badly affected should be destroyed. The perches and other utensils should receive an application of solignum, carbolineum or other insecticide, burn all rubbish and clean up generally.

Treatment.—The legs and feet should be thoroughly saturated in warm water containing soft soap and with the fingers or the aid of a nail brush carefully remove the loose scabs. Dry with a cloth and apply thickly an ointment of paraffin and tallow or oil, equal parts, or sump oil. After two or three days repeat the treatment with the soap emulsion and ointment. Continue until the crusts have been removed and the shanks restored to normal. It is important to treat the first few cases as soon as they are observed, which will save much labour and time.

The Flea.—Fleas differ from other external parasites of birds in that they are capable of jumping. They are shiny and black or dark brown in colour. The conditions required for propagation are undisturbed localities such as cracks in the floors or under boxes and other places when dust and dirt are allowed to accumulate in the runs and houses. It is necessary to emphasise that it is almost impossible to keep poultry houses with loose earth floors or untidy runs free from this pest, except by constantly spraying at considerable cost and annoyance.

The "Sand Flea" or "Stick Fast Flea" is a blood-sucking parasite and spends most of its existence attached to the skin of birds about the head and neck. It firmly attaches itself, burying its head into the outer layers of the skin, where it remains feeding, causing irritation and inflammation. The flea confines itself to the vicinity of infested houses, generally noticeable for the first time on the clothes of the attendant or attached to the head parts of the fowl. They multiply rapidly when an accumulation of dirt, or droppings is found in the presence of a little moisture. The eggs are deposited in the interior of houses where the conditions are favourable to them, or other sheltered positions in the vicinity. They hatch within a week and the larvae thrive in these surroundings, undergoing various stages before reaching the adult stage in two or three weeks.

Prevention.—This parasite, as with all poultry parasites, is capable of elimination by reasonable precautions such as maintaining clean, sanitary conditions for the stock to live in, as would be necessary for the well-being of all other classes of animals. The first essential for the control and elimination of fleas and the most economical is to provide an impervious floor in all poultry houses. The floor of the house should consist of a single layer of bricks or rubble washed over with cement mortar to make it impervious. If at a later date cracks develop, these should be filled in with cement. Appliances such as hoppers and nest boxes or loose pieces of tin, or other refuse should not be left lying about indefinitely in the runs or houses. All utensils should be elevated and supported a short distance off the floor, thus the whole floor space becomes accessible for the birds to scratch in the litter provided for this purpose. Keep the surface of the run

tidy and clean. The dropping boards should be covered with only a thin layer of earth and replaced regularly at short intervals. These simple precautions minimise any possibility of fleas multiplying and becoming established in the vicinity of poultry houses.

Treatment.—It is necessary to state in reference to treatment that unless the surrounding conditions are favourable for eradication of the flea, such as described above, repeated attention, almost indefinitely, might be necessary to render relief to the stock.

In houses where fleas have become established it is necessary to burn all the litter, clean the houses and runs thoroughly, and spray with a strong disinfectant solution. Smear carbolised vaseline, or vaseline containing a little sulphur, on the parts where fleas have attached themselves to the birds. Dust the whole body of the birds well under the feathers with sodium flouride. Before the fleas are entirely eradicated from the immediate surroundings the birds may in a short time again become infested, when a repetition of this treatment will be required.

Report on the use of a 4-unit Gascoigne Milking Machine

Observations by MR. R. JOHN UNSWORTH on the report of a four unit Gascoigne milking machine at the Government Experimental Station, Rhodes Matopo Estate.

(Continued).

I have read and considered with interest the report on the "Gascoigne" milking machine which is installed at the Matopo Estate. The following are my observations which are derived from experience of our numerous plants installed in the Union of South Africa backed by independent testimony of users in this country.

Let me at the outset note that on occasion the makers' instructions have not always been strictly adhered to with unfavourable results. The instructions and advice given by the makers are the result of years of experience gained from thousands of Gascoigne machines installed throughout the World and results obtained at the Institute of Dairy Research at Reading.

Mechanical Efficiency and Cost of Operation.—It is noted that the report says that one native could not handle more than one unit efficiently. This would suggest that the natives of Southern Rhodesia are neither as efficient nor intelligent as those of the Union. Here it is customary for one boy to handle at least two units and to do his own stripping. When six units are in action, two boys usually handle three units each and one boy strips. The usual life of liners in the Union is approximately eight months. We have, however, many cases where liners have lasted twelve months and even fifteen. We have a case in Southern Rhodesia itself where liners lasted twelve months. The other rubbers last from twelve to eighteen months, though we recommend the changing of the long and short milk tubes every nine months.

Vacuum Pump.—Of the large number of plants we have working in the Union only three vacuum pumps have received any attention since being installed over a period of four years.

Pulsators.—We note that the report says that the only parts which gave trouble after *fifteen months* were the pulsators and on several occasions these had to be attended to.

We would point out that owing to the dust in both the Union and Southern Rhodesia, pulsators should be taken down and thoroughly cleaned every two months. This process takes five minutes per pulsator and should be done by white labour. For cleaning the vacuum holes, ordinary pipe cleaners are best. The whole job is very simple but essential. After all you change the oil in your car and clean the plugs and carburetter from time to time to get the best results.

Regarding Yields.—As to whether yields will go up, down or remain stable on changing to machine milking depends chiefly upon management and the hand-milking labour which has been available. One thing is evident—it is impossible to make a fair comparison test if a group of cows are taken and alternatively hand-milked and machine-milked for fourteen day periods.

The handicap against the machine is an impossible one. It speaks wonders for the machine that in this test there was no appreciable difference in the yields. It is over the whole of the lactation that the machine invariably scores. Machine milking tends to enforce better management. There is always the same milker for the cows. The performance of milking is always the same. The machine never gets tired. No human milker can milk his twelfth cow as fast or as well as his first. This the machine will do even though it milks one hundred cows.

We have instances in the Union of herds averaging half a gallon more per cow after the installation of the machine (K. B. Davies, Holcolme Farm, Mooi River, Natal.) Management must be given credit for some of this increase, but better management was the direct result of the installation of the machine. In another case the yield of a herd (H. R. Dukes, "The Recess," Eston, Natal) increased from 103 gallons per day to 140 gallons in the month after installation and remained steady at 130 gallons. Improved management must again receive some credit. Nevertheless the yield of the cows for the first two milkings increased by seven gallons. The first milking was witnessed by a number of Durban Dairymen.

Taking an average by and large, one can expect an increase of about 10% under machine milking in this country. Good management and strict adherence to the manufacturer's instructions are essential. By good management we do not expect a white man present at every milking. A good head-boy is easily trained, and he will take a great pride in the plant. We have plants working in the Union without any white management other than occasional supervision. One four unit plant in the Mooi River district is worked by two umfaans.

Operating Costs.—These were far too high, due no doubt to the generous replacement of rubber parts which the average farmer would watch very carefully. We give below costs carefully worked out for us by competent and practical farmers in different parts of the Union: J. G. Speedy, Zoetvlei, Vryburg and K. B. Davies, Holcolme Farm, Mooi River, Natal, R. A. Carte, Major Sharp "Whinburn," Redbank, P/Bag, Bulawayo, John S. Hodges, Whitsun Farm, P/Bag, Pietermaritzburg.

Regarding the life of the plant and pulsators, here facts prove how far out is the estimate given in the report. The original Gascoigne plant and pulsators are still working at Steyning, Sussex, England, after more than eighteen years use. There is nothing except one or two small parts to wear in the pulsator. In four years we have serviced in the Union 27 pulsators. Of these only fourteen needed any replacement other than the diaphragms which should be renewed every six months.

Depreciation.—As we have pointed out above the life of the plant is unknown as yet for all the originals are still working.

Perhaps twenty-five, not ten years would be nearer the mark. Cleaning costs are too high. Too much Superkinray Powder is obviously being used. A four unit plant should use 200 lbs. per annum. Of course Superkinray Powder is more costly in Rhodesia than here owing to the railage.

A comparison between the report's figures and those of the Gascoigne users is very interesting.

Efficiency and Rate of Milking.—From World tests we find that the four minute rate of milking gives the best results. Exceptionally high yielders giving over five gallons per day may receive another half minute but certainly not more than five minutes. Not that the udders will be affected in any way by leaving the machine on longer, but that the cow is a creature of habit. Once you train her to four minute milking she will comply and will give her milk easily in that time. You will also find you will get less stripping. The strippings in the report are too high. Nevertheless we strongly advocate stripping. The stripping however must be done quickly with a full hand. We have many farmers in the Union who have eliminated stripping entirely from their herds. This has been brought about in the following manner as advocated by the leading Dairy Authorities in the U.S.A.

All first calvers on coming into the herd are machine milked but are not stripped. They know of no other form of milking. Gradually the older cows are eliminated and a completely machine milked herd is the result.

Rate of Milking.—One unit will milk twelve cows per hour. It will be noted that the longer the hand-milkers milked the more tired they got and the longer they took. It should also be pointed out that six hand milkers were required where at the most three machine milkers in charge of a machine should have been used. *Half the cost of labour.*

Cleaning of the Machine and its Efficiency for the Production of Clean Milk.—The report admits that bacteria counts were low until suddenly they increased and after a further five tests it was discovered that the makers' instructions had not been carried out. These were then adhered to and the tests were once more satisfactory. *What happened to the hand count on 29th November, 1939 and 8th December, 1939?

With the machine the cleaning can be done by the head boy and he can be sure that it is clean. In the other case you know you have six milkers all having a chance to contaminate the milk through their hands and their breath, to say nothing of bacteria from the air.

The milk in the machine is covered in its container all the time. The milk does not come into contact with the hands or breath of the native milker. There is no possibility of disease being carried by the milk through contact with the native. We feel that the conditions under which the hand milking was carried out in this test were far cleaner than those which pertain on the average farm. We wonder whether the first draw of milk was

*The high count for the hand milk on the 8th December, 1939, was probably due to unsterilized utensils.

removed from the teats before the machine was placed on the cows. The first draw always contains a large number of bacteria, through contact with the air, etc. *Were the strippings added to the machine milk before the test sample was taken? Little things like this can change a count.

We append details of the counts of the winners of the Royal Agricultural Society of Natal's Clean Milk Competition for the years

Messrs. J. S. Hodges & Son, Umhlongo Nek.
Messrs. Bergview Dairy, Merrivale.

Messrs. Hodges & Son had no steam and their milk had to come in to Maritzburg by train to a Milk Bar (36 miles) and samples were taken from there the following morning at seven o'clock, from bulk. Both these gentlemen are Gascoigne users.

Very few of the plants, other than those of town dairymen in the Union have the advantage of sterilization by steam. Those that have, however, seem to find no difference in the life of the rubbers, according to their replacements.

Considering the Officials of the Government Experimental Station have only had one plant from which to gather their data, they have done an extremely good job. On broad lines we can agree with the majority of their conclusions, and if they have erred on the conservative side, it is only right that they should do so.

They have not during the period asked us for any assistance, nor have they received a visit from our South African representative since installation by our engineer.

I consider the report a very fair one, and if any farmer installs a machine on the findings of this report, he will be more than satisfied.

I should like to take this opportunity of thanking the Officers concerned for their care in this experiment, and for their very clear and interesting report.

(Signed) R. John Unsworth,
Chief Agent and Representative
Southern Africa.

Mr. K. B. Davies says:—

With regard to cost, the figures given below are fairly accurate and give a good comparison of the two systems. Labour is calculated at 1/- plus 3d. rations per day. The number of cows being milked is taken as 40 for a basis with an average of 2½ to 3 gallons per cow. The greater the number of cows or quantity of milk and the higher the cost of labour the more would the comparison favour the machine. As previously stated four Units milk approximately 15 to 20 per cent. quicker than six milkers. The comparison takes no account of an increase in milk which for forty cows averaging 2½ gallons per cow and milk

*The strippings were not added to the machine milk before sampling for a bacterial count.

at 6d. per gallon, means £9 per annum for each 1% increase and I am convinced that the increase in yield due to more efficient and consistent milking is in the region of five to ten per cent. at least. Of course other factors enter so much into this question that my conviction can only be guess work.

Comparative Annual Costs.

By Gascoigne Milker.

6% interest on initial cost of milking machine and separator valued at £180	£10	16	0
2 natives for three hours per day each @ 1/3 .	13	14	0
1 native for three hours per day @ 9d. .	8	3	0
150 gallons petrol @ 1/5 per gallon	10	12	6
4 gallons oil @ 5/6 per gallon .	1	2	0
10% depreciation which should include repairs and replacements (probably too high)	18	0	0
	£62	7	6

By Hand Milking.

6 natives @ 1/3 for 3½ hours per day	£48	0	0
1 native @ 1/3 for 3½ hours per day heating water and separating	8	0	0
1 Umfaan feeding and washing @ 9d.	8	3	0
	£64	3	0

I am very pleased to be able to express my appreciation of your Gascoigne milker and am not exaggerating when I say that the purchase and installation of the plant has been the best investment I have ever made.

I should like to give any who may be interested some facts with regard to cost of operation. My own machine has been in use for one year now, and except for cleaning brushes I have replaced no rubber parts. The teat cups although showing badly perished cracks on the outside, are perfectly smooth and hygienic on the inside surfaces. I have ordered a new set of these, and for my six unit machine I estimate that replacements equal to 1/3 per month per unit. Calculating further running costs for paraffin at 1/2 landed here, and lubricating oil for the engine and vacuum pump at 4/10 per gallon, the operating costs of my six unit plant amount to just under 2/- per month, making the total working and re placement cost about 3/2 per unit.

I have carefully examined the working parts, that is, the pulsator links and the vacuum pump bearings, the vacuum pump has only one moving part running on ball bearings (the ball bearings appear to be the only parts subject to any wear), and I cannot see that any wear of these parts has taken place. In any case the wearing or moving parts are so small and simple that it would not be expensive to replace say a complete set. The depreciation of these machines seems to be so small that it is hardly worth considering.

There is another point—one unit comfortably deals with 12 cows per hour. I should like to know how many hand milkers could do that.

I would just like to add that due to the variable nature of rubber, all sets of rubber parts may not last as well as my first have, but say subsequent rubber parts only last half as well, it would only bring the working costs up to about 4/4 per unit.

I am so enthusiastic about my machine that I invite any interested parties to come and see for themselves.

(Signed) J. G. SPEEDY.

In reply to your letter of the 7th instant, asking for milking costs in connection with our Auto-Recorder, I have to inform you as follows:—

During the last six months our total labour costs for milking, feeding of cows, and dairy work have amounted to £47 6s. 5d. During this time we produced 19,447 gallons of milk, this works out at a cost of .58d. per gallon. In comparison with this our hand-milking costs here at Durban North work out at 1.26d. per gallon giving a difference of .68d. per gallon.

In fairness I must state that owing to the fact that our power being derived from water we have had no power charge, and so far, we have no expense over renewals of liners etc. Our plant has been in use three times daily since last May, and is always sterilized with live steam before use.

We still feel that we are not obtaining full benefits of the machine, for a number of our older cows are not releasing their milk as they should. The heifers on the other hand release their milk without any trouble, when we have got stripping right down to a minimum, we will then receive full benefits of the machine, this of course is merely a matter of time.

If there is any further information you require I will gladly let you have it.

(Signed) DURBAN NORTH DAIRY.
R. A. CARTE.

My 4 unit Gascoigne plant has now been in use for 18 months and has run without a hitch. The plant was installed without skilled assistance and both cows and natives took to it at once. Since using the machine there has been a notable absence of udder troubles.

The cost of operation in Rhodesia appears to be in the neigbourhood of 5/6 per unit per month including replacements of rubber parts.

The plant milks up to 50 cows per hour.

(Signed) MAJOR SHARP,
Bulawayo.

I am in receipt of your letter of the 18th instant, asking for our experience of the Gascoigne Plant as to the loss of a quarter in a second lactation.

Well, as you know, we installed the plant in October, 1937. We then had in the grade herd, three cows with three spindles only. These three cows are now the only three cows in the herd with three spindles, all the others have the full four quarters,

and most are again now in another lactation. No young heifers who started in November 1937 have lost any quarter, and they have now come back again and are milking well on the full four spindles.

During my trip to England in the Summer of last year I had the pleasure of meeting many Gascoigne users there, and I did not hear one of them mention that they were having trouble about cows losing the use of quarters from the machine.

I will be glad if you will send me on twelve more teat cup liners, those which we started with are now wanting to be replaced. They have been in use for over sixteen months, as we have had good service from them. The flat pattern please.

(Signed) JOHN S. HODGES,
P.B. Pietermaritzburg.

P/B Zoetvlei,
Vryburg.

I think that the rubber parts in my machine have given splendid service. They will have given just about one year's good solid service before my new parts arrive. I will be glad if you will convey my appreciation to the makers and my appreciation to your goodself for having sold me such an excellent machine. After almost one year's use, I am in a position to judge the excellence of the machine, and to think that I very nearly bought an . . . . It was pure chance that put me on to you.

(Signed) J G. SPEEDY.

CITY AND BOROUGH OF PIETERMARITZBURG.
Public Health Department,
P.O. Box 89,
Pietermaritzburg.
30th January, 1942.

R. J. Unsworth, Esq.,
187 Alexandra Road,
Pietermaritzburg.

Dear Sir,

Further to your enquiry regarding the results of the "Clean Milk" Competition, I forward herewith the following figures for the winners for the year 1938-1940:—

Year	Name	B. Coli.	Bacteria	Milk Fat	Solids Not Fat	Colour Odour Taste	Sediment	Milk Total	Premises	Grand Total
	Marks Possible	240	520	160	80	240	80	1320	350	1670
1938	Hodges & Son	240	480	155	80	202	48	1205	267	1472
1940	D. J. North ...	240	440	160	80	217½	57	1194½	260	1454½

Yours faithfully,
(Signed) M. MAISTER,
Medical Officer of Health.

Diseases of Fruit, Flowers and Vegetables in Southern Rhodesia.

6.—VIRUS DISEASES OF CABBAGES AND CAULIFLOWERS.

By J. C. F. Hopkins, D.Sc. (Lond.), A.I.C.T.A., and Marie H. Pardy, B.Sc., *Branch of Plant Pathology.*

INTRODUCTION.

For many years it has been recognised that plants of the cabbage family (Crucifers) could only be raised with difficulty in Rhodesia during the warmer months of the year and that to attempt their cultivation during the hot, pre-rainy period of September, October and November more often than not leads to failure. For this reason many vegetable growers confine their plantings of cabbages, cauliflowers, turnips, kohl rabi and so on to the cooler months between May and August, so that the consumer is annually faced with alternating gluts and famines and the producer with boom and slump prices.

Climate and the prevalence of insect pests such as aphids, caterpillars and the Bagrada bug have until recently shared the blame for the unthriftiness of crucifers, but investigations carried out during the past three years have shown that important causes of crop failure are one or more virus diseases, which prevent the normal growth of the plants.

Many such viruses have been reported from the United States in recent years and others of a similar nature from Britain. A comparison of the symptoms described from overseas with those occurring in Rhodesia has failed to identify exactly the local viruses, and experimental results do not agree entirely with those obtained elsewhere. There are, however, close similarities between the Rhodesian diseases and the others, so that there is reason to believe the former are caused by viruses of the same type as the latter.

MOSAIC DISEASE OF CABBAGE.

Description.—The first symptoms usually observed by the grower are the lighter colour of leaves of diseased plants accompanied by twisting or kinking of the midribs (Fig. 2). By the time these symptoms become prominent the plants are fairly well grown and commencing to form heads, so that the earlier stages of the disease are usually not seen. The very first sign of infection by the cabbage mosaic virus is a marked yellowing of the veins of one or more of the inner leaves. This causes the veins to stand out prominently against the darker background of the leaf blade, and is more accentuated in some varieties than in others. Fig. 3

shows vein clearing, as it is known, in the Cape Spitzkol cabbage, Fig. 2 the same condition in Copenhagen Market and Fig. 11 shows the symptom on an infected seedling. Fig. 1 is a healthy leaf of Copenhagen Market for comparison.

Clearing of the veins is followed in one to two weeks' time by what is known as vein-banding, which consists of narrow lines of dark green tissue bordering the veins, separated from each other by pale green areas producing a mosaic-like effect (Fig. 4). Vein banding is not always easily detected but it may take the form of irregular dark green islands surrounded by pale green or yellowish tissue, in which case the mosaic effect is accentuated. About this time it will be seen that much leaf distortion has occurred; the leaf tips bend sharply outwards and downwards, a feature characteristic of the Rhodesian disease (Figs. 8 and 9), and the leaf blades on each side of the midrib grow more vertically upwards than normal, causing the midrib to resemble the keel of a boat (Fig. 10). This symptom is very marked in the variety Surehead

From this stage onwards symptoms vary somewhat with the variety of cabbage. Generally speaking, however, the following sequence is followed. Vein banding becomes less distinct so that the light green areas give the plant a pale, sickly appearance. Growth is much retarded and the central leaves fail to form a firm, compact head (Fig. 10). The outer leaves commence to perish with the appearance of light brown dead areas between the veins (Fig. 5). Small black dots develop in these lesions and black or dark brown lines appear on the veins and veinlets (Fig. 6, slightly touched up). The outer leaves may wither on the plant, but usually become bleached and are shed (Fig. 10). this feature is not constant for all varieties. Early Jersey Wakefield, Copenhagen Market, Golden Acre and other early maturing cabbages, usually form a fairly compact head from the central leaves only, the intermediate and outer leaves falling away as a rosette, instead of closely enfolding the head. The tips of the outer head leaves usually bend back in the manner previously described, giving the marketed cabbage a ragged appearance whilst its quality is poor owing to the woody nature of the veins. Larger varieties such as Succession, Surehead and the Drumheads usually shed the older leaves, whilst those covering the head develop dead areas which later contain a large number of minute black dots resembling a dusting of black pepper. Rotting of heads has not been proved to be directly attributable to the mosaic disease in Rhodesia, although Larson and Walker (1939) report it from America.

Cause and Contributory Conditions.—Mosaic disease of cabbage is caused by an infectious virus, which when introduced into the sap, spreads throughout the plant, interfering with normal development. The symptoms described above result from this interference, and once a plant is infected there is no known method by which it can be cured.

Healthy plants contract infection from diseased ones by the transfer of sap from the latter to the former. This can be accomplished mechanically by rubbing healthy leaves with sap from a diseased plant and is a method used experimentally; it does not, however, appear to be of importance in the field. Probably the

only means by which the disease is spread about is through aphids, or plant lice, as they feed. At certain times aphids migrate from one plant to others, and should the first plant be affected by mosaic, then the insects will carry the infection with them and introduce the virus into healthy plants when they commence to feed. Now it is not the direct injury caused by the aphids feeding which produces the malformed, sickly looking cabbages, as so many people imagine; it is the virus introduced by the aphids which does the damage. This difference may appear academic at first sight, but it is not so because a full understanding of the difference between the insect and the virus is vitally necessary in order to understand the control measures to be described later.

Hot weather is favourable for the development and spread of cabbage mosaic. That high temperatures (75° to 95° F.) hasten the development of disease symptoms in the plant has been proved experimentally during the studies carried out at the Plant Pathology laboratory, whilst temperatures below 65° F. so reduce the activity of the virus that infected plants may recover and produce normal heads. High temperatures also hasten the multiplication and migration of aphids and in this way facilitate the spread of the virus through a crop.

Plants which become infected immediately before winter weather sets in have a very good chance of producing a satis factory crop, and numerous cases have been observed where cabbages showing advanced vein clearing and the commencement of leaf distortion in the bud in early May have developed normally as soon as they became touched with frost and cold nights set in. Plants which become infected in seed-beds and in which mosaic is well established at planting out time rarely produce good cabbages. Although the heads may be compact and the leaf shape normal, the plants themselves remain stunted, the heads are small for the variety and the texture stringy. The same type of plant is reaped when cabbages are set out, in say, July and complete their development in the hot weather. They may make healthy growth at first, despite mosaic infection, or they may not become infected until well advanced, but as soon as day and night temperatures rise in August, mosaic symptoms soon become visible and growth is retarded.

Fntire crop failure often follows the planting of infected seedlings in the spring. The virus checks their growth and the delay in maturity and general lack of vigour leave them exposed to serious injury by such insect pests as leaf-eating caterpillars, Bagrada bug and aphids. Control measures are described at the conclusion of this article.

DWARFING DISEASE OF CAULIFLOWERS.

Description.—The name dwarfing is given to this disease because the chief economic effect is to reduce very materially the size and quality of mature cauliflowers. Plants themselves may be dwarfed, but this is not invariably so, and large, apparently healthy plants may produce curds no more than 3 inches in diameter. It is quite usual for this disease to pass unnoticed until the cauliflowers are mature, although some growers realise that all is not well with the crop by the pale colour of the older leaves of infected plants.

Actually, the cauliflower disease symptoms appear on young plants in a manner similar to that described for cabbage mosaic but with this important difference; vein clearing has not been observed on the cauliflower. In the field, the primary symptoms are difficult to detect, consisting only of a diffused mottling (Fig. 13) which lasts for a few days, to be followed by a pronounced mottle. As a rule this is very prominent in cauliflower and consists of large and small islands of dark green tissue surrounded by narrow areas of paler green, producing a mosaic-like effect. Before the mosaic sets in, curvature of the midrib of the younger leaves commences. Distorted growth soon becomes very marked, the midrib bending back sharply at right angles (Fig. 16) or it may be twisted on its own axis. Usually the two halves of the leaf blade on each side of the midrib fail to expand but grow close together with their upper surfaces touching.

In the meantime other symptoms are to be found on the under surfaces of the older leaves. Groups of minute raised blisters (Fig. 12) appear, which have been mistaken for feeding marks of aphids, but their association with the cauliflower virus has been proved experimentally. Very soon afterwards minute spots appear on the upper surface of the leaf and on close examination each will be found to coincide with a blister beneath. The spots slowly increase in size until they attain a diameter of approximately a quarter of an inch. They are irregular in shape and of a light tan colour and are illustrated in Fig. 14. If such a leaf is held up to the sun it will be seen to contain large numbers of translucent yellowish spots and circles corresponding with the dead spots of the upper surface. Fig. 15 depicts the leaf shown in Fig. 14 viewed by transmitted light.

At the same time as these rings and spots occur, the under side of the affected leaf becomes covered with a kind of stipple of minute black dots which impart a dull grey colour to the surface. From this time onwards, black spots begin to appear on this grey background. They are not rings, but solid spots of a roughly square or circular shape as illustrated in Fig. 17. The leaf commences to lose its green colour and blackish or dark brown lines appear on the lower veins. The blanching of the leaf continues and the margins frequently develop reddish and purplish tinges until eventually the leaf is shed. In the meantime, the younger leaves become severely distorted, with pronounced vein-banding, the curd is much dwarfed and is usually loose. It rapidly becomes discoloured and is then evil smelling when cooked.

Cause and Contributory Conditions.—The disease is caused by an infectious virus which has been proved experimentally to be transmitted in the same manner as the cabbage mosaic virus, namely, by mechanical inoculation of infected sap and by aphids. The virus itself, however, is distinct from that of cabbage mosaic, because it produces different symptoms when inoculated into cabbage. A further point of different is that the cauliflower virus becomes active during cold weather and is suppressed when temperatures rise above about 65° F.

Control.—Beyond choosing favourable planting dates, control of both cabbage and cauliflower diseases depends on preventing the viruses from gaining entrance to the plants, for once they are

infected there is no known way of curing them and the severity of the diseases which develop depends almost entirely on subsequent air temperatures. Neither of these diseases is known to be seed-borne, although the possibility of a "one-in-a-million" transmission through seed cannot be entirely ignored, but provided the plants are kept free from aphids, there is little chance of serious spread by such means as handling. Inoculation experiments carried out locally have shown that the viruses are readily transmitted to healthy plants by aphids, but only with some difficulty by rubbing infected juice on to leaves. There is not the same danger of spread by handling as with tobacco mosaic, for instance. Efforts must therefore be directed to preventing infected aphids from reaching the plants, especially young plants.

The first step is to keep the vegetable site clear of weeds, for many weeds harbour the viruses and act as food for aphids. In the category of weeds can be placed old plant refuse, particularly of cabbages, cauliflowers, brussels sprouts, rape, turnips, radishes and kohl rabi, such flowers as annual stock and Alyssum and weeds like Shepherd's Purse and charlock, common in the Eastern districts, all of which belong to the cabbage family. Many other plants, including swiss chard, spinach, zinnia, petunia and tobacco are hosts of one or other of the viruses, so that much more care and foresight is required in the choice and preparation of land and seed-beds for the cultivation of crucifers than is the present custom. Seed-beds must not be placed near to growing plants of the varieties enumerated owing to the danger of the viruses being present in any one of them.

Having taken the necessary precautions in relation to alternate host plants, it is necessary to guard against infection introduced by winged aphids. Experiments conducted at the Plant Pathology laboratory have shown conclusively that newly emerged seedlings, with only the seed leaves expanded, as shown in Fig. 7, can be readily infected by a single winged aphid. The insects may visit seedlings at this stage in considerable numbers and escape detection because they feed on the under surface of the leaves, which are crowded so closely together as to hide them completely.

Spraying with tobacco extract and soap, as recommended in the Food Production Committee's bulletin No. 1201, at weekly intervals has proved effective in keeping the plants free from serious aphis infestation, but even this has not given complete protection against infection by the viruses. It has been found that rogueing of diseased plants, especially in seed-beds, is necessary to eliminate the viruses entirely. Experiments conducted in co-operation with the Branch of Entomology showed that by weekly spraying with tobacco extract (1-500) and soap plus lead arsenate (3 lbs. per 100 gallon wash) up to the time the plants were hearting, it was possible to raise good marketable cabbages in October and November with only minor loss from the "hot weather" virus or leaf-eating caterpillars. Ninety day varieties such as Early Jersey Wakefield, and Copenhagen Market were the least affected by mosaic. The slower growing, larger types were not as satisfactory and it is doubtful if these varieties should be grown during the hot months in areas where crucifers have been cultivated for some years. In fact, it is advisable to

refrain from planting crops of the cabbage family for a period of about three months every year to allow aphids infected with the mosaic virus to die off. A "close season" of three months throughout the Colony would mean, of course, with the present cold storage facilities, that the consumer would only be able to obtain cabbages for six months out of the year. Some system of staggering the "close season" might, however, be arranged by District Food Production Committees.

Insufficient tests have as yet been conducted on the economy of spraying cabbages in the field in Rhodesia to warrant making general recommendations, but the importance of spraying seed-beds for the control of virus diseases has been amply demonstrated, and all vegetable growers are urged to adopt the method immediately in order to reduce the serious losses of cabbages, etc., which at present occur. The need for a very early application must again be stressed in order to prevent early infection of plants by the viruses.

The benefits to be derived from raising healthy transplants will be much reduced if infection takes place soon after trans planting, so every grower should make a point of seeing that after cabbages are cut, all old stumps and leaves are immediately removed from the land and covered by soil or buried in the compost pit Old stumps are favourite breeding grounds for aphids, and, as old plants are likely to be infected with one or other virus, if left in the lands they will quickly become a source of infection for the new crop. In this connection it is important to remember that plants which are much delayed in maturing are almost certainly diseased and generally of poor quality. It is useless to leave such plants in the hope that they will fill out. A valuable piece of land is kept out of cultivation, and at the same time diseases are transmitted to the new plantings. Field hygiene of a high standard is required for all market gardening, but it is absolutely essential for the successful cultivation of crucifers in Rhodesia.

TECHNICAL DISCUSSION

The identification of the diseases described above and their causal viruses is complicated by various factors in Rhodesia, chief of which is the rapidly changing temperatures during the months of May to September and in regard to the cauliflower disease, the very short period during which temperatures below 70° F are experienced

Cabbage Mosaic.—The name mosaic has been given to the disease of cabbages in Rhodesia because it presents many of the symptoms of the mosaic disease described by Larson and Walker (1939) from Wisconsin. The sequence, clearing of veins, vein banding, mottle, leaf distortion, interveinal necrosis, black necrotic spotting and leaf abscission is followed in Rhodesia and would indicate that, if not identical, the Wisconsin and local viruses are very closely akin. Furthermore, the Rhodesian virus has been transmitted experimentally by juice inoculation and by the aphids *Myzus persicae* and *Brevicoryne brassicae** to cabbage, cauliflower and kohl rabi producing symptoms very similar to those reported by Larson and Walker. The disease is also favoured by high temperatures. Attempted infection of annual stock, wallflower and tobacco gave indefinite results probably owing to unfavourable glass-house conditions which interfered with normal growth of the experimental plants.

The following symptoms developed in the undermentioned hosts when inoculated by leaf rubbing and by aphids with the juice from mosaic cabbage (Cape Spitzkol variety).

*Kindly identified by Dr. W. J. Hall, Citrus Experimental Station, Mazoe.

Cabbage.—Chlorotic spots, vein chlorosis, vein banding, diffuse mottle, necrosis and abscission of leaves.

Cauliflower.—Slightly raised chlorotic spots scattered over inoculated leaf, vein chlorosis of young leaves followed by vein banding, diffuse mottle, much distortion of midrib and cupping of leaves. The vein banding and mottle were not as pronounced as in cabbage.

Kohl rabi.—Slightly raised chlorotic lesions scattered over leaf, vein chlorosis, mottling, waving of leaf margins and distortion of leaves. Plants stunted.

Dwarfing of Cauliflowers.—The symptoms of this disease do not correspond entirely with the description of any cauliflower disease in available literature. There appears to be a divergence of opinion among American workers as to the identity of the diseases reported in recent years from that country and the specific viruses do not yet seem to have been determined.

Field observations on the development of the Rhodesian disease differ somewhat from those made on artificially inoculated plants. In particular the prominent mosaic which occurs on young leaves in the field was absent from the experimental plants. In the same way the grey stipple and black spots which develop on old leaves in the field were not observed in the glass-house, but this may have been due to arrested development of the experimental plants in pots.

Juice from a cauliflower plant in the field showing advanced symptoms of the disease, with small curd, kinked leaves, and black spotting of the old leaves was transferred to cabbage, cauliflower and *Nicotiana glutinosa* with the following results:—

Cabbage.—Small raised blisters on upper surface of inoculated leaf, minute necrotic spots, blisters on under-surface, diffuse mottle of young leaves, systemic mottle, necrotic spots, no severe distortion.

Cauliflower.—Small raised blisters on inoculated leaf, diffuse mottle only, distortion of midribs and curling of leaves.

N. glutinosa.—Diffuse mottle at edges of leaves, light green islands of tissue, yellow flecks, circular pale brown necrotic spots with white centres.

It will be noted that vein chlorosis did not occur in either cabbage or cauliflower.

The Rhodesian disease presents features of several described virus diseases. Fig. 13 above would appear to be the same as Fig. 1.C. of Clayton (1930) and has the same pattern as Fig. 1.B on cabbage of Hoggan and Johnson (1935), but when inoculated to *Nicotiana glutinosa* the virus produced a mottle and flecking followed by pale brown necrotic spots with white centres after twelve weeks. The mottle and fleck are recorded by Hoggan and Johnson but not the necrosis. These workers do not, however, state how long their plants were kept under observation. Smith (1935) depicts a similar necrosis on *N. glutinosa* inoculated with his cabbage ring spot virus.

Smith (1937) further records diffuse systematic mottling for this virus which he identifies with Brassica virus 1, in cauliflower, of the type in Fig. 13, but does not record necrosis or distortion for this host. The same virus causes ring spotting of cabbage without vein chlorosis and necrotic rings develop on the underside of the leaf. There is no mention, however, of solid spots similar to those shown in Fig. 17.

The black ring disease recorded by Tompkins *et al* (1938) produces necrotic lesions on cabbage, cauliflower and *N. glutinosa* with marked chlorosis of cauliflower leaf in the later stages. The symptoms as illustrated in Figs. 2B, 3A and 6C do not, however, accord with those of the Rhodesian disease.

A further necrotic disease, ring necrosis of Larson and Walker (1941) has no resemblance to any observed Rhodesian disease.

The identity of the cauliflower dwarfing disease remains obscure, but there is reason to believe that it may be caused by a mixture of viruses, one of which is active during hot weather and the other when low temperatures occur.

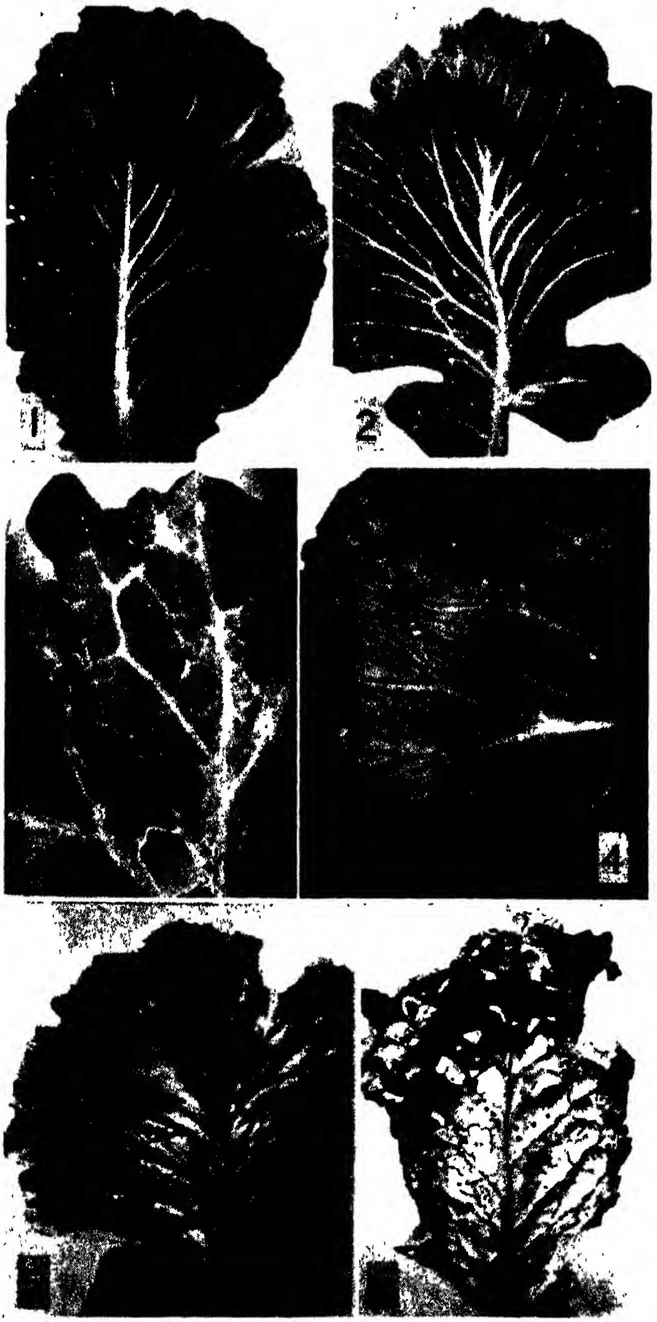


Fig. 1.—Healthy cabbage leaf.
Fig. 2.—Vein clearing and distortion of midrib
Fig. 3.—Advanced vein clearing.
Fig. 4.—Vein banding or mosaic.
Fig. 5.—Necrosis or dead areas between veins.
Fig. 6.—Black spots and lines on dead bottom leaf (from plant in Fig. 8).

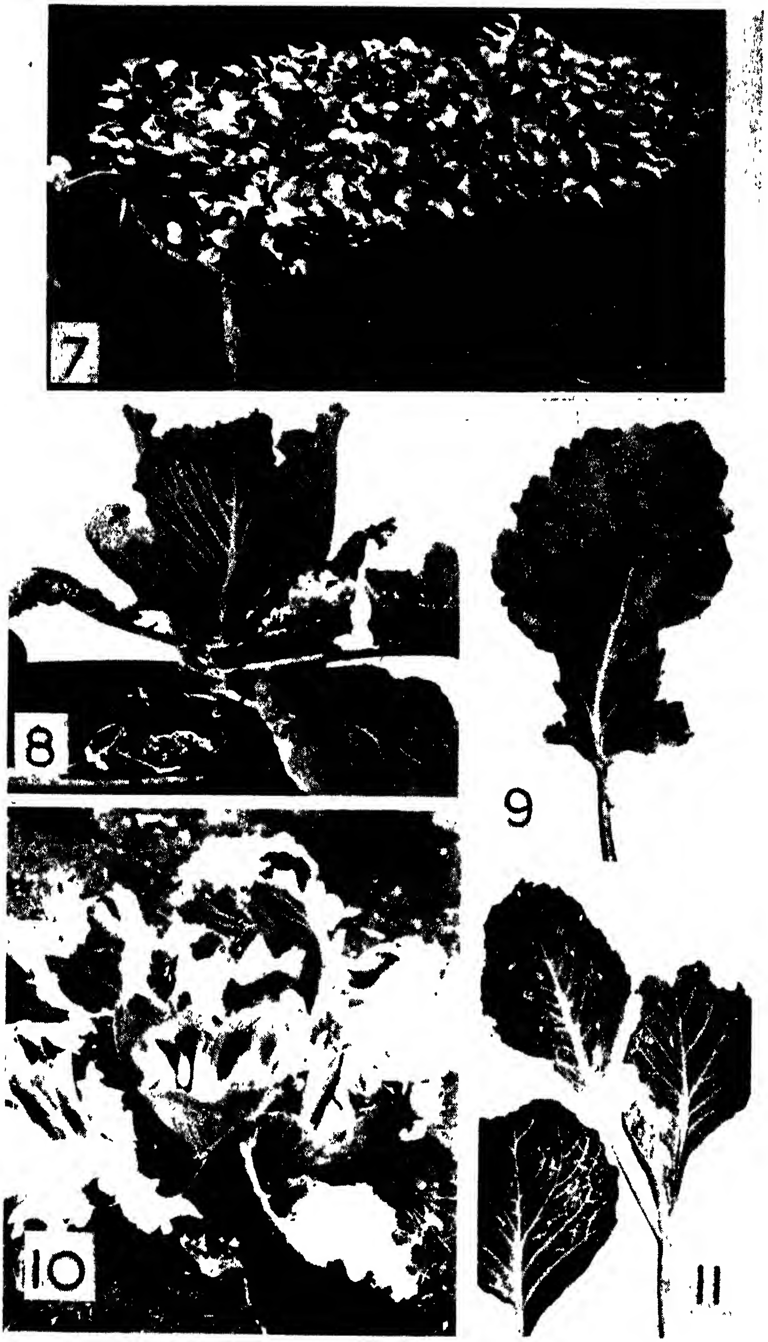


Fig. 7.—Seedlings of this size should be sprayed.
Fig. 8.—Copenhagen Market cabbage, artificially infected from cauliflower by means of *Myzus persicae*, the peach aphis. Note bending backwards of leaf tip and "keeling" of midrib.
Fig. 9.—Leaf from plant in Fig. 8.
Fig. 10.--Loose head and dropped leaves of cabbage infected by mosaic.
Fig. 11.—Vein clearing on cabbage seedlings infected at stage shown in Fig. 7 by winged aphids.

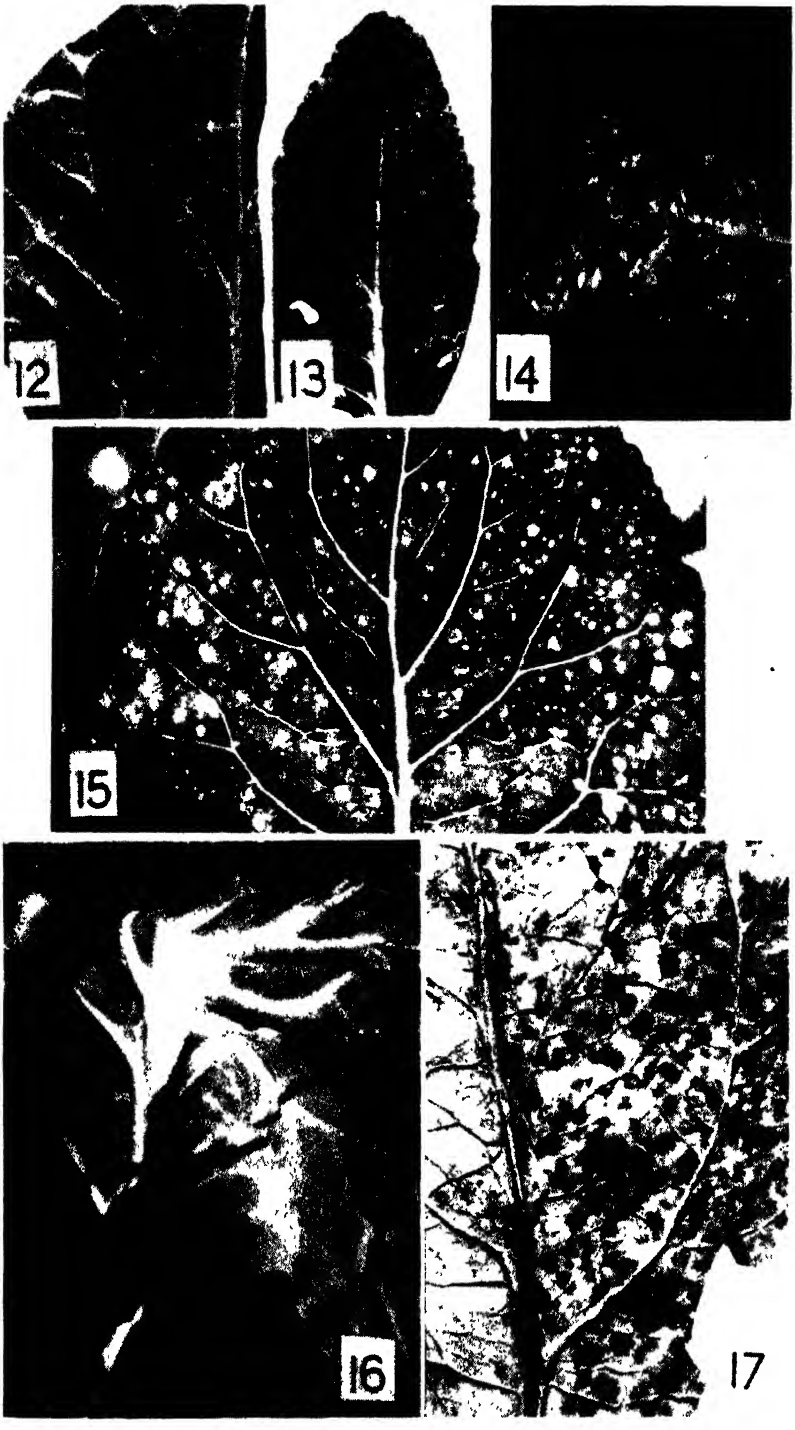


Fig. 12.—Blisters on lower surface of cauliflower leaf.
Fig. 13.—Diffuse mottle in All Seasons cauliflower.
Fig. 14. Necrosis of upper surface of outside leaf.
Fig. 15.—Fig. 14 as seen when held up to the light.
Fig. 16.—"Kinking" of cauliflower midrib.
Fig. 17 —Black spots and grey background on underside of old cauliflower leaf. Natural infection.

Mottle, prominent mosaic, and extreme leaf distortion occur in cauliflowers grown during hot weather (70° F. to 90° F. shade temp.) and these are symptoms of the cabbage mosaic virus in this host. When temperatures drop generally (35° F. to 65° F.) systemic mottle followed by ring and spot necrosis are commonly found. If cold weather suddenly ceases and warm days set in, then mosaic mottling appears on young plants, the leaves becoming extremely twisted and distorted about the head, which is much dwarfed.

Owing to the short period during which suitably low temperatures are general, it has not been found possible critically to investigate the cauliflower disease. The incubation period of the virus or viruses concerned is so long that hot weather sets in before full development of the disease takes place. On the other hand, tests with the cabbage mosaic virus leave little doubt that it is identical with that of Larson and Walker and it may be that the slight differences recorded are due to an admixture of other crucifer viruses which are partially inactivated by high temperatures or masked by the virulence of the cabbage mosaic virus.

There appears to be no evidence of the presence of the cauliflower mosaic virus of Tompkins (1937).

No parasitic organisms have been isolated from any of the described leaf lesions.

SUMMARY.

1. A mosaic disease of cabbages and cauliflowers is very prevalent in Rhodesia and is fully described.
2. It has been shown to be due to a virus which can be transmitted by juice inoculation or by means of the peach and cabbage aphids.
3. Another virus disease of cauliflowers is described, which is transmitted by the same means.
4. Control measures are recommended, based on local experiments.
5. A technical discussion on the identity of the diseases is included.

REFERENCES.

Clayton, E. E. (1930)—*Journ. Agric. Res.*, 40, p. 263.

Hoggan, I., and Johnson, J. (1935)—*Phytopath.*, 25, p. 640

Larson, R. H., and Walker, J. C. (1939)—*Journ. Agric. Res.*, 59, p. 367.

——— (1941)—*Journ. Agric. Res.*, 62, p. 475.

Smith, K. M. (1935)—*Ann. App. Biol.*, 22, p. 239.

——— (1937)—A Textbook of Plant Virus Diseases, London.

Tompkins, C. M. (1937)—*Journ. Agric. Res.*, 55, p. 33.

Tompkins, C. M., Gardner, M. W. and Thomas, H. R. (1938)—*Journ. Agric. Res.*, 57, p. 929.

Soya Beans.

By H. C. Arnold, Manager, Agricultural Experiment Station.

Notes on Cultivation.—The exceptional qualities which nature has bestowed on the soya bean, combined with its suitability for storing and transportation, make the crop worthy of serious attention by the farmers of this Colony. No other food crop suitable for large scale cultivation under local climatic conditions possesses so many desirable characteristics. The beans contain a high proportion of proteins, oils and vitamins, as well as other valuable nutrients. They can be used for human consumption as well as for all classes of farm livestock. They are more resistant to drought than maize and can be more easily grown, reaped, threshed and stored than other types of edible beans. The growing plants are not seriously affected by insect pests and the seed is not attacked by weevils. Soya beans thrive on a wide range of soil types, provided they contain sufficient humus and phosphate and are not excessively acid. The demands of the reaped crop on the plant nutrients of the soil are lower than those of maize, and if the whole crop is ploughed under for green manure, the beneficial effect on the cropping power of the soil is comparable with that of sunnhemp when used for the same purpose.

The improvement in the varieties suitable for local climatic conditions, which has been effected by the introduction of non shattering types and breeding them with heavy croppers, has provided the farmers of this Colony with another crop which can be economically cultivated.

The purpose of this article is to present the information we have gathered so far about the methods of cultivation found suitable for local conditions, and to suggest methods for the utilisation of the soya bean crop.

The varieties available fall into two distinct groups, namely, those whose seed is especially suited for edible and manufacturing purposes and others whose heavy yields of fodder make them particularly suited for use as hay or silage.

Edible and Manufacturing Varieties.—As a general rule only those with light coloured seed coats—usually cream to creamy yellow—are acceptable to the milling trade, and only such should be grown when it is intended to use the seed for human consumption either in the unprocessed or the manufactured state. Furthermore, our new yellow-seeded varieties yield heavier crops of seed than the fodder kinds.

Two years ago the only variety which could be recommended for large scale sowing was one known as Potchefstroom No. 184, but since that time the Hernon strains evolved at this Station have been distributed to all parts of the Colony, and these have yielded heavier crops than the former variety in nearly every instance. One or two farmers reported that they prefer the

Potchefstroom No. 184 because it matures more quickly than the Hernon strains. Many farmers planted their soya beans too late in the season to obtain the heaviest crop of seed. The best time for sowing the Hernons is early in the month of December. At that period of the year, however, most farmers are busy with other crops, and they find they cannot sow their soya beans until the latter part of that month.

In order to ascertain whether the early maturing P. 184 variety would be more suitable than the Hernons for late planting, a trial was laid down last season in which sowings were made each week between December 15th and January 19th inclusively. Six plots each of P. No. 184 and Hernon No. 107 were sown at each weekly interval. The average yields of each group of six plots are given in the tabulation below. P = Potchefstroom, H = Hernon.

Yields of Beans in lbs. per acre.

	Sown Dec. 15th		Sown Dec. 22nd		Sown Dec. 29th.	
Strain	P. 184	H. 107	P 184	H. 107	P. 184	H. 107
Yields . lbs.	882	1,107	915	974	764	799
	Sown Jan. 5th.		Sown Jan. 12th.		Sown Jan. 19th.	
Strain	P. 184	H. 107	P. 184	H. 107	P. 184	H. 107
Yields lbs.	634	675	450	557	378	427

These returns show that in spite of its early maturity the P. 184 variety did not yield more heavily than the Hernon strain, even when sowing was deferred as late as January 19th.

It is also shown that late sowing reduces yields, and this fact should be kept in mind when farmers compare their cash returns from soya beans with that from other crops which may have had the advantage of a longer period of growth.

Strain Trials.—Several Hernon strains have been issued to farmers during the past two seasons. Of these, Nos. 18, 39 and 268 have consistently given satisfaction to the majority of those who have grown them. At this Station a more recent selection, namely, No. 107, produced heavier yields than the foregoing in previous seasons trials, but during the season just past, its yields, equalled, but were not heavier than those of Nos. 18 and 268. However, it retains its seed for a longer period than No. 268 without shattering, and it is more homogeneous than the other strains; for these reasons in future it will replace No. 268 in our trials. The position at the present time, therefore, is that strains Nos. 18 and 107 are considered to be the best. No. 39 yields as well as the others, but its dwarf habit of growth makes it less suited for machine harvesting. No. 107 has not been issued to farmers hitherto, but sufficient seed is now available for issues of a few pounds each to bona fide farmers in this Colony under our Co-operative Experiment scheme. In our strain trials last season these Hernon strains yielded 36 per cent. more seed than Potchefstroom No. 184. One reason for the yield of the Hernons being so much heavier than P. 184 in these trials is probably due to their having been sown early, viz., December 4th, 1941. In the date-of-planting trials cited above the Hernon No. 107 sown on December 15th yielded 25 per cent. more than P. No. 184,

but from the January 19th sowing, the Hernon strain yielded only 13 per cent. more than P. No. 184. It is seen, therefore, that early sowing is associated with heavy yields, but the "best" time to sow will be influenced to some extent by the other operations on the farm, **for in spite of their "non-shattering" qualities, it is not advisable to delay harvesting the crop for more than a week or so after the leaves have dropped.**

The work of cross-breeding strains and testing promising selections is being continued with a view to effecting further improvements in the yield and seed-retaining ability of new strains. The ability to retain the seed in closed pods for some few weeks after the plants reach maturity would enable farmers to grow the crop on a wider scale, and to feel confident that they would not sustain loss should circumstances demand the postponement of harvesting operations.

Growers of the Hernon strains must remember that they are not entirely homogeneous, and it may be found that a few "off-type" plants will appear. The portion of the crop which is to be used for seed should be carefully inspected in the field, and plants with "off type" habit of growth, pubescence of the leaves and stems, and those bearing a poor crop of pods and/or appearing diseased should be removed before the crop is reaped. Although a small proportion of dark coloured beans may not reduce the commercial value of the crop, all brown and black beans should be removed from the "seed" before it is sown in order that the creamy yellow colour normal to these strains may be maintained. Strains whose normal pubescence is grey are less likely to produce dark coloured seed than those whose pubescence is brown. *For this reason growers of Hernon Nos.* 5, 36 *and* 39 *would be well advised to change to a grey type such as Hernon Nos.* 18 *and* 107 *if they wish to grow soya beans for seed purposes.* As the differences in the appearance of the seed of the various Hernon strains are so small, it is impossible to identify them from seed alone, and it is, therefore, most important that the grower should carefully record the name of his strain in order that he may supply the correct name with every bag he sells for seed purposes. *Seed which is not correctly named will have little value above that of beans for commercial uses.*

Hernon No. 18.—The mature plant has several fine branches which are almost as long as the main stem, giving the plants an open or lax appearance. The terminal leaves are much narrower and more pointed than those formed in the early part of the season. Leaves and stems are covered with grey hairs. About 130 days are required to reach maturity. The seed is small to medium in size, light yellow in colour, "short kidney" in shape. The majority of the seeds have dark brown hilums, though a few have light brown hilum scars. The fine stems make it very suitable for use as hay. It is thus a good dual purpose type, giving good yields of hay if required, though not as heavy as the Jubiltan hay strains.

Hernon No. 107.—The mature plant has a single main stem with short side branches. The terminal leaves, though smaller, are about the same shape as those formed earlier in the season. Leaves and stems are covered with grey hairs. About 128 days are required to reach maturity. The seed is medium sized though

slightly larger than that of No. 18, dull light yellow in colour, "short kidney" in shape. The hilum is small and light brown in colour.

At lower altitudes than that of this Station, such as in the Mazoe Valley, the periods required to reach maturity given above may be appreciably less, in some cases by as much as 1 to 3 weeeks.

Soil and Rainfall Conditions.—As a general rule the soil and climatic conditions required by maize are those best suited for soya beans. During the season just past, when the rainfall was below the average amount, a number of farmers found their soya beans were less adversely affected than the maize on adjoining land and it has been noted that this crop appears to be less sensitive than maize on land which is not well drained. Farmers who have grown soya beans and other edible beans (not velvet beans) in the same field, report that they found the soya bean less exacting as regards soil conditions than the other kinds. On this Station the best crops have been produced in seasons in which the summer rainfall has ranged between 25 and 35 inches and has been evenly distributed. The range of soils suited for soya beans extends from loamy sands to fairly stiff clays, and those which are slightly acid to slightly alkaline, produce equally good crops. However, extremes should be avoided; soils which are shallow. waterlogged, very acid and sterile sands are quite unsuitable.

The humus content of the soil seems to be of great importance. In the season 1938-39 when unusually wet and cold weather was experienced, the growth of the soya beans on this Station was noticed to be much more thrifty on certain parts than on others only a few feet away, although previous manurial treatments had been the same. Samples of soil from these areas were analysed by the Chief Chemist's Branch and it was found that although all the samples contained approximately the same amounts of inorganic plant foods, those which had produced the heaviest crops of soya beans contained a little more humus than the others. The lack of sufficient humus had reduced the crop by 75 per cent. on some of the areas. Since that time further experiments and reports received from farmers have supported those conclusions. This suggests that soya beans may require conditions suitable for the development of mycorrhiza on their roots in addition to the nodule forming bacteria which are known to provide an important source of the nitrogen requirements of the plants. In the absence of humus, growth is often found to be subnormal in spite of satisfactory bacterial nodulation of the roots.

Fertiliser Trials.—Experiments were conducted during the season 1940-41 in which dressings of phosphate and muriate of potash were applied both alone and also together. Each dressing was replicated eight times. The fertilised plots did not yield heavier crops than the unfertilised control plots. The ineffectiveness of the fertiliser may have been due to the unfavourable weather conditions, but it is thought that insufficient humus may have been a contributory cause also.

Trials which include dressings of 8 tons of kraal compost, 1 ton of lime, 200 lbs, of phosphatic fertiliser and 100 lbs. of potash per acre both as single and as combined dressings, were

commenced in the season 1941-42. The results in the first season were inconclusive, owing to a portion of the land being more severely affected by the drought than the remainder, and to inherent inequalities in the fertility of the land. At present the indications are that the compost, phosphate and lime all had a beneficial effect, but that dressings of potash are not required under these soil conditions. It will be necessary to continue these trials over a number of seasons before it will be possible to assess the relative importance of those dressings which appear to have had a beneficial effect.

The experience acquired from farmers' reports and trials on this Station indicate that soya beans thrive best on soils which are fairly well drained, contain moderate amounts of humus and phosphate, and are not too acid.

Inoculation with Specific Bacteria.—It is well known that all leguminous farm crops live in symbiotic relationship with certain kinds of bacteria whose activities on the roots of the plants result in the transformation of free nitrogen of the air to a form in which it can be utilised by the plants, and is highly beneficial to them. The particular kind of bacteria favoured by the soya bean plant is not usually found in Rhodesian soils. For this reason when this crop is first grown on the land it is advisable to inoculate the seed to obtain the desired benefit from their activities. If the majority of the plants are found carrying the bacterial nodules, it will not be necessary to inoculate that land again, provided the interval between soya bean crops is not more than three or four years.

No investigational work designed to ascertain the longevity of these bacteria has been done in this Colony, but in America, after a period of eighteen years virile bacteria were found in certain soils, but as a rule the number in the soil decreases rapidly after two or three years. They disappear more quickly in acid than in neutral or alkaline soils. Although there are several methods of introducing the bacteria to the land, the simplest under present conditions are (a) smearing the seed with bacteria laden soil; (b) soaking the bacteria laden soil in milk (or water) for 24 to 36 hours and using the liquid to inoculate the seed. The latter method is preferable when the seed is to be sown with a machine.

Material for Inoculating the Seed.—A quantity of specially prepared soil is available at the Agricultural Experiment Station, Salisbury, for distribution to farmers who are growing soya beans for the FIRST time. Sufficient to inoculate 400 lbs. of seed will be sent free of charge upon application to the Manager. For the second year's crop the farmer should grow his own bacteria by sowing inoculated beans, or some of the "bacterial soil" supplied, on a few square yards in a convenient place. The soil should be well supplied with compost and phosphate and the seed should be sown about 4 inches apart each way. The roots of the plants will spread through every inch of this soil and the bacteria will thoroughly permeate it. Soil prepared in this way will be more heavily laden with bacteria than that obtained from land planted at ordinary spacings. Alternatively, suitable material can be obtained by taking soil from near the taproots of plants carrying

a satisfactory number of nodules. The *nodule bearing* roots can also be collected, reduced to powder by passing through a hammer mill and used instead of soil for inoculating the seed.

Seed Inoculation: The Dry Soil Method.—The seed should first be thoroughly coated with either skimmed milk, sugar solution, or very thin glue to ensure that the bacteria laden soil will adhere to it. While the seed is still wet, sprinkle the soil over it and turn it over and over in order that every seed may be smeared with the soil. A little raw rock phosphate should also be applied to the seed as it is being turned. When the beans are to be machine sown, any excess of soil should be removed by vigorously sifting the dried seed, in order that the loose soil may not cause clogging and wear in the drill boxes.

The Muddy-milk Method.—Allow 2 or 3 pints of milk for each bag of seed beans; boil it and allow to cool. Put in a vessel and pour 2 or 3 lbs. of soil into it. Stir well.

The milk may be poured off and used at once if desired, but better results were obtained in tests, from milk which had remained with the soil from 18 to 36 hours before application to the beans. The soil-milk mixture should be kept in a cool place in order that coagulation may be prevented. Before using stir the mud and milk, allow the larger particles of soil to settle, and pour off the liquid. Make a heap of the beans on a hard floor, sprinkle the muddy milk on them, turning them over meanwhile to ensure that every bean gets its share. A handful of raw rock phosphate should be sprinkled over the wet beans. Care should be taken not to moisten the beans so much that their coats wrinkle. If it is found that an excess of moisture has been applied, the seed can be dried off by applying dry soil, or rock phosphate.

Keep the inoculated seed away from bright sunlight. Immediately after inoculation spread the seed thinly in a shady place until it is thoroughly dry. It may then be bagged and kept until required for sowing. It may be kept for several weeks if necessary, but is best used soon after treatment. Drilling the seed is preferable to broadcasting, but if the latter method must be adopted, sow on a cloudy day and cover the seed as quickly as possible.

Inoculation not only increases the crop to which it is applied, but the residues which remain in the soil have a more beneficial effect on the crops which follow. If it is desired to thoroughly establish these bacteria in the soil, a dressing of lime should be given if it is found necessary to correct soil acidity, and a second crop of soya beans should follow the inoculated crop either in the first or second season.

SOWING THE SEED.

Early Sowing is Best.—Generally, the heaviest yields are obtained from varieties which require the longest period to reach maturity. It is not advisable to sow before the rains commence, because the seed cannot survive conditions which are unfavourable for steady growth after germination has been started. From the latter part of November to the middle of December is the

most suitable period for sowing our heaviest producers, but sowing may continue until the end of December or later, at the risk of reaping reduced yields if the rainy season is curtailed. The trials mentioned above in which two varieties were sown at weekly intervals between December 15th, 1941, and January 19th, 1942, show that every week's delay in sowing the crop after mid-December has passed, increases the risk of reducing the yield. The crop of Hernon No. 107, sown on December 15th, yielded 5½ bags per acre, but that sown on January 19th yielded only two bags per acre.

(To be continued).

AT LAST.

The shoemaker must stick to his last, but the farmer must stick to agricultural cleanliness first *and* last.

CLEANLINESS AIDS

VICTORY

Analyses of Rhodesian Foodstuffs.

By The Division of Chemistry.

A considerable amount of data is available in such valuable textbooks as Henry & Morrison, Hall, Wood, Kellner, and those of many other authors regarding the chemical composition of animal foodstuffs, but these analyses refer to products that have been grown in countries other than our own.

During past years many Rhodesian grasses, legumes, cereals, and other common animal foodstuffs produced and fed in the Colony have been analysed for various purposes in the chemical laboratories of the Department of Agriculture, and it has long been felt that the analytical data available put in the form of a bulletin might be of value to farmers and others.

The increased attention being paid to the feeding of cattle makes the demand for a series of analyses of our commoner foodstuffs more urgent, and it has therefore been decided to issue the following tables, as it is felt that the information contained therein will be of value in assisting farmers in compiling suitable balanced rations for stock from the foodstuffs available on their farms.

In most textbooks giving the analyses and nutritive ratios of foodstuffs the latter are usually computed from the digestible and not from the crude nutrients.

No digestibility trials on cattle have ever been carried out in this Colony, therefore no data are available to show the digestibility of any of our common foodstuffs.

In the circumstances, the nutritive ratios shown in the last column of these tables have been calculated on the crude nutrients, and, although not in accordance with the usual method adopted, it is considered that they will prove useful in classifying foodstuffs, as they show the relative proportion of proteins to carbohydrates and fats.

Calculations.—The Protein Factor.—The protein content of foodstuffs is ascertained by determining the nitrogen content and multiplying this figure by the factor 6.25.

This factor is derived from the assumption that the whole of the nitrogen present in foodstuffs is in the form of protein and that all proteins contains 16 per cent. of nitrogen, i.e., $\frac{100}{16}$. This figure is fairly accurate for animal proteins, but is only roughly correct for vegetable proteins, as these latter contain more nitrogen than animal proteins. Factors varying from 5.5 to 6.25 have been suggested for different vegetable proteins, but although 6.25 is too high for a number of these, this factor has been used for calculating the protein content of all the foodstuffs in the following tables except wheat, where the factor is 5.7.

The Nutritive Ratios in these tables are calculated by adding to the percentages of carbohydrates and fibre, the percentage of fat multiplied by 2.3, and dividing the sum by the percentage of crude protein, so arranged that the numerator is unity. Thus:—

$$\text{Nutritive Ratio} = \frac{\text{Crude Protein.}}{(\text{Fat x } 2.3) + \text{Soluble Carbohydrates} + \text{Fibre.}}$$

$$= \frac{1}{\dfrac{(\text{Fat x } 2.3) + \text{Soluble Carbohydrates} + \text{Fibre.}}{\text{Crude Protein.}}}$$

PERCENTAGE COMPOSITION OF RHODESIAN FOODSTUFFS.

I.—CONCENTRATES.

(a) Grains and Seeds.

	Moisture	Ash	Crude Protein	Ether Extract	Fibre	Carbo-hydrates	Nutritive Ratio.
	%	%	%	%	%	%	%
Belhambra (Monkey Grape) (Fruit) .	9.8	3.6	13.6	4.3	10.4	58.3	1:5.8
Buckwheat .	9.14	2.55	10.50	2.56	14.45	60.80	1:7.7
Cotton Seed	7.9	3.6	19.0	16.9	23.6	29.0	1:4.8
Flax Seeds .	4.6	4.2	20.6	35.7	8.6	26.3	1:5.7
Kaffir Corn (2 analyses)....	10.92	1.64	10.90	2.48	2 17	71.89	1:7.3
Linseed Grain (white flowering)	6.97	3.84	22.75	30.23	5.67	30.54	1:4.6
Maize (Dent)	7.0	1.3	9.4	4.5	1.9	75.9	1:9.1
Maize (Flint)	7.4	1.8	10.9	5.3	1.9	72.7	1:7.8
Maize (Hickory King)	9.8	1.2	9.3	4.4	1.4	73.9	1:9.2
Maize (Salisbury White)	10 2	1.4	9.3	4.7	1.5	72.9	1:9.2
Milo Maize	8.74	1.57	10.98	2.67	2.66	73.38	1:7.6
Muguruzwuzwu Seeds	18.6	1.9	12.0	21.7	5.0	40.8	1:8.0
Niger Oil Seeds	5.7	6.5	23.7	18 5	29.3	16.3	1:3.7
Nyouti (Munga)	9.42	2.18	11.37	4.31	1.57	71.15	1:7.3
Oats, Hull-less	11.43	2.13	21.00	7 81	2.00	55.63	1:2.8
Oats, Kherson ..	9.51	3.90	15.31	5.32	11.26	54.70	1:5.1
Oats, Kinvarra .	9.66	3.92	12 25	8.70	13.71	51.76	1:7.0
Panicum sp. (Native grass seed) . .	11.12	2.20	8.18	1.55	3.48	73.47	1:9.8
Pumpkin seeds .	5.54	3.93	33.91	39.57	15.05	2.00	1:3.2
Rapoko	10.58	3.16	7.62	1.30	2.88	74.46	1:10.8
Rice, Native (Grain).	10.1	1.2	7.4	1.1	....	80.2	1:11.2
Rice, Native (Hulls)	6.9	12.9	4.1	3.5	37.6	35.0	1:19.7
Sunflower heads . .	10.49	5.15	12.25	12.90	24.52	34.69	1:7.3
Sunflower seed (black sel.)	5.76	2.28	14.37	26.77	25.24	25.58	1:7.8
Sunflower seed (white sel.)	5.54	2.61	16.63	24.86	25.99	24.37	1:6.5
Vegetable Ivory Palm Fruit—							
Kernel	7.3	2.3	6.1	4.8	24.1	55.4	1:14.7
Husk	7.4	2.4	2.8	0.7	50.6	36.1	1:31.5

(a) *Grains and Seeds.*—(Continued).

	Moisture	Ash	Crude Protein	Ether Extract	Fibre	Carbo-hydrates	Nutritive Ratio.
	%	%	%	%	%	%	%
Vi-Vi (Lucaena glauca) seed	9.0	4.0	32.6	6.8	10.4	37.2	1:1.9
Wheat (Jubilee)	11.4	2.1	13.2	2.4	2.0	68.9	1:5.8
Wheat (Kenya Governor)	11.3	2.0	12.4	2.2	2.5	69.6	1:62
Wheat (Punjab)	10.2	2.1	10.8	1.6	2.1	73.2	1:7.3
Wheat (Sabavero)	10.2	2.4	13.2	1.6	2.8	69.8	1:5.8
Wintersome seeds	9.9	2.1	11.4	3.6	3.6	69.4	1:7.1

(b) *Miscellaneous Concentrates.*

Avocado Pear (flesh)	69.4	1.2	1.7	15.6	1.6	10 5	1:28.2
Avocado Pear (seed)	69.6	1.2	1.7	1 0	1.2	25.3	1:16.9
Brewer's grains.	5.8	3.7	18.4	7.0	20.1	45.0	1:4.4
Cassava Meal	12.2	2.3	1.5	0.3	3.0	80.7	1:56.3
Coffee bran	11.9	4.3	2.0	0.2	60.3	21.3	1:4.1
Copra cake	4.9	4.2	13.1	33.3	8.7	35.8	1:9.2
Corn and Cob meal	12.4	1.4	8.3	4.1	4.7	69.1	1:10.0
Cotton seed cake	7.3	4.9	33.6	13.3	13.4	27.6	1:2.1
Germ Meal (2 analyses)	12.1	2.8	9.1	5.3	3.6	67.2	1 9 2
Ground Nut Cake (decorticated)	6.2	4.1	45.9	16.2	4 5	23.1	1:1.4
Hominy Chop . (3 analyses)	10.26	1.48	8.75	4.56	4.90	70.06	1:9.8
Linseed Oil Cake	6.8	9.0	34.6	7.9	10.5	31.2	1:1.7
Locust Meal	7.06	6.84	47.47	22.91	10.81	4.91	1:1.4
Maize Alcohol Residue	10.1	4.3	27.8	12 1	8.8	36.9	1:2.7
Maize Bran .	8.4	1.8	7.9	5.6	14.8	61 5	1:11.3
Malt Culms	7.0	5.8	22.3	0.9	14.1	49.9	1:3.0
Mealie Meal (3 analyses)	10.22	1.30	8.58	4.69	1.96	72.61	1:9.9
Mimosa Meal	7.06	4.15	11.25	0.92	21.18	55.44	1.7 0
Palm Kernel Cake (2 analyses)	7.8	2.5	13.7	13.5	18.6	43 9	1:6.8
"Seepu" . . .	9.92	13.91	12.19	2.30	10.19	51.49	1:5 2
Sunflower Heads, seeds removed	11.73	11.62	8.86	3.18	18.19	46.42	1:8.1
Wheat Screenings	8.8	7.2	11.2	2.1	13.4	57.3	1:6.7

(c) *Slaughter-house By-products.*

Blood Meal (2 analyses)	9.48	3.60	80.50	0.28	0.91	5.23	1:0.08
Bone Meal (2 analyses)	6.4	67.1	20.6	2.2	0.9	2.8	1:0.4
Meat Meal (3 analyses)	6.7	15.4	56.8	17.3	2.3	1.5	1:1.3

(d) Leguminous Pods and Seeds.

	Moisture	Ash	Crude Protein	Ether Extract	Fibre	Carbo-hydrates	Nutritive Ratio.
	%	%	%	%	%	%	%
Acacia albida (entire pods)	7.1	3.4	11.1	1 4	27.5	49.5	1:7.2
Acacia arabica (entire pods)...	9.2	4.0	10.9	2.9	15.7	57.3	1:7.3
Acacia benthami (beans)...	6.96	3.45	12.56	4.57	9.46	63.00	1:6.6
Acacia sp. (entire pods)...	8.58	5.65	14.22	1.48	21.55	48.52	1:5 2
Albizzia amara (entire pods)...	9.31	3.29	12.25	6.89	32.69	35.57	1:6.9
Bauhinia thonningii (entire pods)...	6.1	3.9	6 6	3.1	23 7	56.6	1:13.2
Camelthorn (Acacia giraffeae) (entire pods)...	9.36	3.29	11 37	1.61	30.98	43.39	1:6.9
Carob bean (Ceratonia siliqua) (pods without seeds)...	5 68	2.25	3.24	2.09	9.90	76.84	1:28.3
Carob bean (seed)...	8.14	3.44	16 38	2.55	7.93	61.56	1:4.6
Carob bean (entire pods)...	6.10	2.45	5.48	2.17	9.56	74.24	1:16.2
Cowpeas, or Kaffir beans (seeds)...	13.9	3.4	23.4	1.8	5.9	51.6	1:2.6
Dahl (seeds)...	7.0	3.8	21.0	1.3	9 1	57 8	1:3.3
Dahl (complete pods)	7.2	4.6	13.3	1.3	17.9	55.7	1:5.8
Dichrostachys nutans (bean)...	7.08	4.59	18.55	2.07	20.27	47.44	1:3.9
Dolichos bean (seed)...	8.03	3.90	24.72	1.00	9.77	52.58	1:2.6
Gram, large white (seed)	5.66	2.34	20.13	5.74	2.41	63.72	1:3.9
Gram, brown (seed) .	6.31	2.64	21.90	4.37	10.81	53.97	1:3.4
Gram, horse (seed)	4.3	6 8	23 6	0 6	7.5	57.2	1:2.8
Ground Nuts—							
Rhodesian Valencia—							
Entire pods...	7.36	2.35	24.71	36.31	16.02	13.25	1:4.6
Husks...	10.65	3.06	4.81	0.98	61.16	19.34	1:17.2
Kernels...	6.36	2.14	30 79	47.10	2.23	11.38	1:4.0
Virginia Bunch							
Entire pods...	8.82	2.64	22.07	32.90	18.12	15.45	1:4.9
Husks...	10.84	2.40	4.58	1.09	64.50	16.59	1:18.2
Kernels...	8.15	2.73	27.94	43.57	2.56	15.05	1:4.2
Madagascar Butter Bean (entire pods) .	9 3	3.6	11.8	1 8	26.0	47.5	1:6.6
Mnondo (Isoberlinea Globiflora) pods...	7.5	3.2	6 5	0.9	43.5	38.4	1:12.9
Mung Bean (black-seeded) (seeds)...	4.4	6.5	26.3	0.6	4.3	57.9	1:2.4
Nyomo (bean)...	9.4	3.6	16.3	6.8	5.7	58.2	1:4.9
Somerset Velvet Beans (beans only)...	11.0	3.1	22.9	5.1	5 7	52.2	1:3.0
Somerset Velvet Beans (entire pods)...	10.4	3.4	13.3	3.0	14.3	55.6	1:5.8
Soya Bean, Biltan (seed)	7.8	4.1	40.3	16.1	4.9	26.8	1:1.7
Soya Bean, Herman (seed)	8.1	4.4	36.7	18.7	4.9	27.2	1:2.0
Soya Bean, Otoxi (seed)	7.9	4.2	45.2	16.6	4.4	21.7	1:1.4
Sunnhemp (seed)...	7.6	3.6	29.4	3.5	11.1	44.8	1:2.2
Swartzia Madagascariensis (entire pods)...	8.86	2.43	5.69	1.12	21.10	60.80	1:15.0

(*d*) *Leguminous Pods and Seeds.*—(Continued).

	Moisture %	Ash %	Crude Protein %	Ether Extract %	Fibre %	Carbo-hydrates %	Nutritive Ratio. %
Sword Bean (Canavallia ensiformis)- -							
Beans only...	7.1	3.2	27.6	1.5	11.8	48.8	1:2.3
Pods only	7.9	4.7	9.5	0.5	28.6	48.8	1:8.3
Complete (bean and pod)	7.8	4.8	14 0	0.9	23.9	48.6	1:5.3
Velvet Bean (White Stingless) (seed)	10 18	3.54	26 94	6 13	3.11	50.10	1:2.5
Velvet Bean (White Stingless) pods without contained seeds	9.49	5.06	4 19	0 98	27.27	53.01	1:19.7
Velvet Bean (White Stingless) (entire pods)	9.87	4.21	16.89	3 85	13.78	51.40	1:4.4
Vi-Vi (Lucaena glauca) (entire pods)	19.5	4.7	17.5	1.1	20.6	36.6	1:3.4

II.--DRIED ROUGHAGE.

(*a*) *Hay from Grasses, etc.*

Bermuda Salt Bush (Osteospernum muricatum) .	9 9	9.4	10 9	3 9	27.6	38.3	1:6 8
Black Turf grass (Ischaemum glaucostochyum)	13 19	9 15	9 56	1 80	32.09	34 21	1:7.2
Buffalo grass (Setaria Chevalieri)	9 40	11 16	11.25	2.06	24 87	41.26	1:6.3
Climbing Belhambra (Phytolacca octandra) ..	13.9	11 3	22 8	2 1	15 0	34 9	1:2.4
Common Buffel or Guinea grass (Panicum maximum)	13.11	11.74	12.38	1 49	23 13	38.15	1:5.2
Chloris virgata (old lands grass)	12.15	9.91	9 07	1.55	30.02	37.30	1:7.8
Digitaria setivalva	11.30	10.13	11.69	2.30	24.54	40.04	1:6.0
Dryland grass (Pennisetum ciliare)	10.57	11.60	14.88	1 66	28.50	32.79	1:4.4
Gonya grass (Urochloa bulbodes)	10.74	11.54	15.81	1.77	21.98	38.16	1:4.1
Gonya grass (Urochloa mosambicensis)..	11.53	11.36	13.06	1 32	24.71	38.02	1:5.0
Hunyani grass (Chloris gayana) creeping strain	9.90	8.36	9.31	1.74	28.83	41.86	1:8.0
Kikuyu	5.9	9.6	10.2	1.2	31.7	41.4	1:7.4
Kokoma	9.7	9.9	8 3	1.5	30.6	40.0	1:8.9
Limpopo grass (S.A.; Antelope grass, Rhod. (Echinochloa pyramidalis) ...	17.55	8.41	12.88	1.99	27.55	31.62	1.4.9
Maize Sheaths..	8.1	3.9	8.0	0.7	25.7	53.6	1:8 9
Complete Maize Plant minus Sheaths	9.7	5.0	5.1	0.8	26.9	52.5	1:14.0
Manna Hay	6.2	7.3	7.0	1.2	30.2	48.1	1:11.6
Milanje grass (Digitaria milanjiana)	10.41	8.23	11.19	2.12	26.16	41.89	1.6.5
Napier Fodder	7.4	8.4	9.0	1.4	34.6	39.2	1:8.6
Purple topped Buffel (Panicum maximum)... . . .	12.64	11.48	14.13	1.60	21.48	38.67	1:4:5

(a) *Hay from Grasses, etc.*—(Continued).

	Moisture	Ash	Crude Protein	Ether Extract	Fibre	Carbo-hydrates	Nutritive Ratio.
	%	%	%	%	%	%	%
Rapoko grass	11.08	8.40	11.00	1.57	28.84	39.11	1:6.5
Reed Timothy grass (Setaria phragmatoides)	11.31	12.08	15.00	1.22	28.39	32.00	1:4.2
Rhodesian Blue grass (Andropogon gayanus)	9.53	6.37	10.50	2.29	30.82	40.49	1:7.5
Rhodes grass (Chloris gayana) (5 analyses)	7.9	7.0	8.5	1.2	36.9	38.5	1:8.9
Smooth Rhodesian Tussock grass (Setaria plicatilis)	11.84	8.90	13.69	2.02	29.05	34.50	1.5.0
Setaria pabularis	11.23	12.72	13.00	0.88	29.28	32.89	1:4.9
Spekboom (Portulacaria Afra)	4.4	9.4	8.1	3.6	20.0	54.5	1:10.2
Sudan	10.1	6.7	8.9	1.3	30.9	42.1	1:8.5
Sunflower plants (complete)	7.74	7.90	11.50	6.79	31.80	34.27	1:7.1
Swamp Couch (Haemarthria fassiculata)	17.64	5.79	6.63	1.52	26.68	41.74	1:10.8
Teff Grass	10.9	6.7	10.4	1.7	26.2	44.1	1:7.1
Upright False Paspalum (Brachiaria brizantha)	14.77	10.23	9.31	1.66	26.30	37.73	1:7.3
Wintersome fodder	13.3	4.4	4.1	0.8	26.0	51.4	1:19.3
Woolly Finger grass (Digitaria pentzii)	11.46	8.43	14.25	2.01	28.58	35.27	1:4.8

(b) *Hay from Legumes.*

Cow Pea Hay	10.0	7.3	10.0	1.1	29.6	42.0	1:7.4
Crotalaria intermedia	7.5	5.7	14.4	1.5	33.3	37.6	1:5.2
Dahl	12.00	3.73	20.12	1.80	6.84	55.51	1:3.3
Dolichos Bean Hay	11.1	6.5	12.1	2.4	21.3	46.6	1:6.1
Ground Nut Hay	9.5	11.9	10.6	1.3	27.0	39.7	1:6.6
Kudzu vine (complete)	4.52	6.28	13.38	2.43	34,57	38.82	1:5.9
Kudzu vine (leaves)	8.05	7.13	18.06	3.56	19.81	43.39	1:4.0
Kudzu vine (stalks)	7.81	5.19	5.29	0.95	42.63	38.12	1:15.7
Lucerne (flowering stage)	74.0	2.0	4.5	0.8	9.5	9.2	1:3.2
Lupinaria	...	...	12.13				
Soya Bean (Biltan) Hay	15.4	5.8	9.9	3.0	31.6	34.3	1:7.4
Sunnhemp Hay (4 analyses)	7.66	5.11	11 42	1.01	42.17	32.63	1:6.8
Vaalbosch (Eriosema Engleri)	12.80	4.68	9.31	2.94	27.50	42.77	1:8.3
Velvet Bean Hay	9.3	7.8	13.3	2.5	27.6	39.5	1:4.2
Wedge Field Pea	7.2	6.1	22.6	2.4	25.2	36.5	1:3.0

(c) *Dried Roughage from Miscellaneous Green Leaves of Trees, Plants, etc.*

Agave Americana leaves	85.6	1.8	0.7	0.2	2.2	9.5	1:17.3
Banana leaves	10.2	10.9	12.8	2.0	26.6	37.5	1:5.4
Banana stems	12.4	16.2	5.8	1.3	22.7	41.6	1:11.6
Dolichos bean leaves	...	...	17.3	...			

(c) Dried Roughage from Miscellaneous Green Leaves of Trees, Plants, etc.—(Continued).

	Moisture	Ash	Crude Protein	Ether Extract	Fibre	Carbo-hydrates	Nutritive Ratio.
	%	%	%	%	%	%	%
Dolichos bean stems	...	.....	7.25	...	..	...	.....
Granadilla leaves	8.92	8.13	15.37	4.64	10.88	52.06	1:4.8
Indigofera, leaves and flowers ...		.	20.0				...
Madagascar Butter Bean, leaves and stalks	9.2	7.4	8.1	3.6	36.9	34.8	1:9.9
M'futi tree leaves			16.2				
Mistletoe. Viscum verrucosum?	2.4	9.3	13.3	5.1	21.9	48.0	1:17.4
Paw Paw leaves	9.7	11.1	22.5	3.9	9.7	43.1	1:2.7
Vaalbosch leaves	6.22	7.99	14.06	8.39	26.44	36.90	1:5.9
Vi-Vi (Lucaena glauca) branches	13.2	7.0	18.6	2.8	19.3	39.1	1:3.5
Vi-Vi (Lucaena glauca) leaves only	10.4	10.0	17.9	5.8	12.6	43.3	1:3.9
Water Hyacinth (Eichornia crassipes)	7.7	17.3	13.2	1.2	19.1	41.5	1:4.8
Willow leaves (common)	11.0	5.2	9.8	2.8	17.4	53.8	1:7.9
Willow leaves (weeping)	13.9	8.8	14.4	2.5	15.5	44.9	1:4.6

III.—FRESH ROUGHAGE.

Roots, Tubers, Fruits, Leaves.

Edible Canna tubers (first year)	88.1	0.72	0.72	0.03	0.53	9.90	1:15.0
Edible Canna tubers (second year)	84.4	0.60	0.77	0.04	0.63	13.56	1:20.0
Emfenge leaves (Cussonia spicata)	22.1	6.1	6.7	2.7	15.4	47.0	1:10.0
Kigelia pinnata (sausage tree), fruit only	85.4	0.66	0.84	0.88	4.29	7.93	1:17.0
Majorda Melon	94.62	0.36	0.44	0.03	0.43	4.12	1:10.5
Prickly Pear fruit, complete	..	..	0.70	..	.	..	...
Prickly Pear fruit, pulp			0.88	.	.	...	.....
Pumpkins	86.8	0.9	1.8	0.8	1.8	7.9	1:6.4
Sunflower leaves	78.70	3.95	4.12	0.70	1.97	10.56	1:3.4
Sweet potato tubers (Early Butter)	78.70	0.70	1.38	0.16	0.38	18.68	1:14.0

IV.—SILAGE.

Dolichos beans—							
Green	76.19	2.12	4.44	1.28	5.25	10.72	1:4.3
Air-dried	11.74	7.87	16.44	4.76	19.45	39.74	
Kudzu Vine—							
Green	62.71	4.33	4.95	1.55	11.59	14.87	1:6.1
Air-dried	13.88	10.00	11.44	3.57	26.77	34.34	

IV.—SILAGE.—(Continued).

—	Moisture	Ash	Crude Protein	Ether Extract	Fibre	Carbo-hydrates	Nutritive Ratio.
	%	%	%	%	%	%	%
Maize—							
Green	70.79	1.45	2.08	1.68	2.80	21.20	1:13.4
Air-dried	12.13	4.37	6.25	5.08	8.42	63.75	
Napier Fodder—							
Green	73.08	3.67	1.14	0.98	10.49	10.64	1:20.5
Air-dried	10.10	12.26	3 81	3.29	35.03	35.51	
Niger Oil Plant—							
Green	66.80	3.95	4.69	4.99	7.41	12.16	1:6.6
Air-dried	7.27	11.05	13 12	13.96	20.71	33.89	
Sunflower—							
Green	81.44	2.26	2.94	1.10	3.04	9.22	1:5 0
Air-dried	11.40	10.79	14.06	5 26	14.48	44.01	
Sweet Potato tops—							
Green .	82.69	2.14	2.77	0.81	2.65	8.94	1:4.9
Air-dried	11.70	10.92	14.13	4.12	13.54	45.59	
Sunnhemp (green)	78.24	2.00	2 53	0 69	10.71	5.83	1:7 2
Tango Daisy fodder (Tithonia) (green)	79.0	2.3	1 8	0.3	9 4	7.2	1.9.9
Tango Daisy fodder (Tithonia) (air-dried)	14.9	9 2	7 2	1.4	38.1	29.2	
Veld Grass (Red soil) air-dried (3 analyses)	14.8	7.9	5 7	1 6	26 2	43.8	1.12.9
Veld Grass (Sandveld), air-dried (2 analyses)	9.7	7.2	3 7	0 6	40.1	38.7	1:22.0
Vlei Grass, air-dried (3 analyses)	10.6	8.6	5.5	2 3	33.5	39.5	1:14.2
Velvet Bean							
Green ...	81.11	2.29	2.94	1.17	5.00	7.49	1·5.2
Air-dried	9.43	11.01	14 12	5.62	23.98	35.84	
Velvet Bean, plus Maize air-dried	7.6	3.1	10.2	3.8	12.9	62.4	1:8.2

The Farm Home

Recipes.

A correspondent sends the following useful recipes:

Bottled Beans.—Make a saturated solution of salt, about 8 tablespoons of salt to a pint of water, or until the water will not absorb any more salt. Cut up a number of green beans and pack them into screw top jars. Pour over the salt solution until the jars are full. Screw on the lids and store in a dark place.

To serve: Drain off the salt solution, soak the beans in clear water for 3 hours. Drain, and boil in fresh water for ½ to ¾ hour. Even fairly old beans are made tender by bottling in salt.

Konfyt.—Take a ripe watermelon and remove the soft portion surrounding the pips and the green skin. The remainder of the melon is cut into squares which are well pricked with a fork. Place in a large basin and pour over 2 quarts of water in which a tablespoon of lime has been dissolved. Leave to soak overnight. Pour off the lime water and wash the melon squares in several clear waters. Make a syrup of 1 pint of water, 1 lb. of sugar and ½ pint of lemon juice to each pound weight of fruit. Bring the syrup to the boil, add the fruit and boil until the melon squares are brown, clear and soft. From 3 to 4 hours.

Orange Wine.—(Ready for use when six months old.) 12 oranges; ½ lb. raisins; 3½ lbs. sugar. Peel 6 oranges and put the skins in the oven to brown. Then pour one quart of boiling water over the skins. Cut up the other 6 oranges as well as those you have already peeled, and pour 3 quarts of cold water (boiled) over them, and the raisins.

When the first liquid is cold mix both together and stir every day for 8 days, then strain off, add 3½ lbs. sugar and stir every day for 8 days, then bottle. (The bottles should be only half filled to allow the gas to be given off, and if possible corks used instead of screw tops.)

A little sugar in each bottle helps to take the sediment to the bottom of the bottle and after a week or so, the wine should be turned off into fresh bottles, when a little more sugar will again help to clear it.

Celery Soup.—Wash and cut up about two heads of celery, add seasoning and brown in butter for about 20 minutes. Add about 2 quarts of stock and simmer gently till the celery is tender. Rub through a sieve, return to pan, thicken with a little flour and bring to the boil. Cool slightly, add ½ pint of milk and, if liked, 1 gill cream. Serve with croutons.

Farming Calendar

The July-August months of the Farming Calendar were omitted from the last issue of the Journal so are included in this issue in order that readers may have the Farming Calendar complete.

LIVESTOCK.

JULY.

Cattle.—The bulls may again be put into the herd at the end of the month. Watch for any unthrifty cattle and get them into the home paddock and feed them before they become really poor. The value of a good provision for winter feed will be apparent now. Except under purely ranching conditions winter feeding should be general. Where areas have been properly reserved for winter grazing these should be in use now. Generally the treatment of the dairy herd should be continued on the same lines as in June.

This is one of the coldest months of the year, and milk production as a rule is low. Those cows which are being milked should receive a full winter ration of succulents (ensilage, pumpkins or majordas), hay.

Sheep.—As for June, where necessary dose for hookworm.

AUGUST.

Cattle.—On the early granite and sand veld probably the worst of winter is over so far as grazing is concerned, and a nice bite of green grass is appearing. Care should be taken where cattle are allowed to graze on the early burnt grass not to let them get too much at first. On red soil farms the haystack will still be required, and in all cases a certain amount of hay or ensilage should be held in reserve against the possibility of very late rains. In dairy herds on any soils whatever, feeding, housing and bedding should not be relaxed.

Calves, especially young ones, must be carefully watched; they should not run too far, and are better inside, except when the weather is warm. They should be fed a little sweet hay, bean meal, linseed, ground nuts or ground nut cake and a small ration of green food.

This is usually a critical time of the year for young dairy stock. For dairy heifers, weaned calves, etc., there is possibly no better ration than one consisting of maize silage, legume hay and small allowance of mixed concentrates, and these feeds, if supplied in liberal quantities, should serve to keep the young stock in a thrifty, growing condition.

Sheep.—In many places there will be grazing on early burns, see that the ewes and lambs get the best. In the drier parts this is one of the most critical months. A stack of bean hay and a little maize will solve most of the troubles.

SEPTEMBER.

Cattle.—Ranching cattle go through a very critical time from now on. Where possible, it will be wise to keep an eye on those cows that may be expected to calve early, with a view to feeding them if necessary and seeing that they do not get too poor. The supplementary feeding of ranch stock is always a difficult problem. But a small provision of cotton seed, good veld hay, kaffir corn or sunflower silage at this time may be the means of saving many head of cattle when the rains are late. This is a critical month for young stock. Weaning should be completed as soon as conditions permit. The dairyman will carry on much as in August; he will, however, use his discretion (in accordance with the conditions of his veld) as to the use of ensilage, pumpkins or other bulky and succulent food. He will be wise not to shorten the supply of concentrated foods for some time to come. A little hay or ensilage should still be kept in reserve until the rains have fallen in reasonable abundance. The object should be to build up the condition of the cows expected to calve when the rains come.

Sheep.—Same as for August, except that March lambs, if well grown, should be weaned and either put on to good grazing or allowed ample

bean hay and a little maize. A little feed now will ensure that they will be ready to top the Christmas market. Where nodular worm is present dose twice at 30 day intervals as was recommended for January.

OCTOBER.

Cattle.—Ranching cattle on granite veld will in many instances be in fairly good condition on account of the early grass in the vleis, etc. On the diorite soils and later veld the cattle owner will still have to watch his weaker cattle carefully. In any case all supplies of hay, ensilage, majordas, etc., should be carefully husbanded in anticipation of possible late rains, but at the same time every effort should be made to prevent cattle becoming weak.

During the month of October and until such time as the rains have commenced and green grazing is available, dairy stock requires to be almost entirely stall fed. Cows in milk and cows due to calve should be liberally fed on succulents and concentrates in order that they may commence the dairying season in good condition, and make full use of the early grazing for milk production. Dairy cows that are underfed at this time of the year invariably produce milk of poor quality, and usually throw weedy undersized calves; furthermore, they do not pick up in condition until comparatively late in the season.

During October, the cow's ration should consist of succulents such as silage or green feed, etc., legume hay of good quality and a liberal allowance of concentrates; a pound or so of a feed such as ground-nut cake is invaluable for dairy stock at this time of the year.

Sheep.—The rams should be put in now to ensure March and April lambs. Good green grass or a bit of supplementary feeding will flush the ewes and ensure a bigger crop of lambs. Keep the rams in during the day and feed them Continue dosing the weaners well. Commence dosing very regularly, and in the more moist areas keep all sheep out of the vleis.

DAIRYING.

JULY-AUGUST.

No difficulty should be experienced in producing first-grade cream at this time. In cold, windy weather due precautions should be taken to ensure that the milk when separated is not below 90 degrees.

Most cheese-makers cease their cheese-making operations at the end of the month, as milk is usually scarce. Cheese in the store room should be carefully watched, as cheese mite is likely to appear on old mature cheese. In order to prevent the undue drying out of the cheese, the floor of the cheese room should be sprayed with water from a watering can

SEPTEMBER.

This is generally the quietest month of the year from a dairying standpoint, as the production of dairy products is at its minimum. Town milk supplies are now falling off, and a greater use of purchased concentrates in the form of ground nut cake and bran is advisable to keep up the milk supply. Very little cheese is made during this month Old cheese should be cleared out of the store-room before the advent of hot weather, and if possible should be sent to be stored under cold storage conditions. Considerable difficulty is to be expected in making butter during this month, as the early spring grass is shooting in the vleis and the butter is consequently very soft. To counteract this, greater use should be made of feeds which produce a hard fat, such at cotton seed cake.

OCTOBER.

Weather conditions are generally fairly warm during the month of October, and every precaution should be taken to keep the cream, which is used for butter-making or which is sent to the creamery, as cool as possible. The can or bucket containing the cream should be placed in a basin of water or concrete trough, in the dairy, and exposed to a draught; a piece of kaffir blanket, which dips into the water, should be wrapped around the can or bucket containing the cream. Churning of cream for butter-making is best carried out early in the morning—before sunrise if possible; the coolest water obtainable should be used for washing the butter whilst in the granular stage.

At this season of the year cheese-makers may find that the milk is deficient in butter fat; this is generally the result of under-feeding or

unsuitable feeding. Cheese made from milk of low fat content is invariably dry and hard, defects that are accentuated by over cooking the curd or by cooking at too high a temperature. The curd should be firmed in the whey at a temperature not higher than 98 to 100 degrees F.

FORESTRY.

JULY.

Care should be taken to protect all plantations from fire by hoeing belts round them and burning any grass likely to be dangerous. Cuttings of various deciduous trees may be taken and struck in nurseries. Continue pricking out conifers into tins or beds. In preparation for early planting in case the season is favourable, limited sowings of eucalypt seeds may be carried out. If labour is available, preparation of land for planting to be taken in hand.

AUGUST.

Seed beds may be prepared and eucalypt seeds sown if required for planting early in the season. Make sure that all fireguards are in order.

SEPTEMBER.

All cuttings struck in sand in July and not yet transplanted into good soil should have this done as soon as possible. Preliminary sowings of eucalypt seeds should now be made, so that transplants will be ready in case the first half of the rainy season should prove favourable. The fire season will now be at its height and care should be taken to see that all plantations are protected.

OCTOBER.

The main sowings of eucalypt seeds should be made either in seed trays or in well prepared seed beds. A well-broken soil forming a fine tilt in the seed bed ensures more successful germination and better plants. If transplants are being used, any seedlings which are ready should be pricked out.

Seedlings in open beds may have their tap roots cut so as to develop fibrous lateral roots, and thus produce good type stocky plants. Remember the plant feeds through its roots, hence the better root system the healthier the plant and the greater its chances of successful establishment. If conditions are favourable, cross-plough and harrow land for planting broken up in early autumn. Continue to guard against fires.

CROPS.

JULY.

Support agricultural shows, and add to your list of exhibits. Advertise your goods through the shows. Interested people will see them. If you require to make purchases of seed for next season, judge by the exhibits on the show what grower can best supply your needs, and place your orders accordingly. Attend the shows and go there to learn all you can about your business. Seed maize previously selected in the field should be butted and tipped and hand shelled. Keep the butt and tip grain for check row planting by hand. Do not over-irrigate winter crops, and do not irrigate when the wind is from the south, as this often means frost at this time of year. Troublesome weeds, such as darnel grass or drabok, may be removed from cereal crops by hand. Ploughing should be pressed on with, and maize stalks and roots of maize and other trash from the crop should be collected and burned or composted. A land littered with unburnt and unrotted stalks and roots cannot be brought to a suitable tilth for planting and subsequent cultivation. Silage and sweet potaoes and other succulent feeds will have come into general use now, the potatoes being lifted from the land as required. The application of phosphatic fertilisers which are to be ploughed or harrowed in can be begun. Take the opportunity, during this and the next month or two, of inspecting all boundary and paddock fencing and gates, and effect repairs where required. Give a coat of paint to implements, wagons and carts. This protects the woodwork from rotting and iron from rust. If not already marketed, the main potato crop will probably be sold about now.

AUGUST.

Prepare your compost heaps. Grade the potatoes properly according to size. The buyer wants potatoes—table or seed—of even size, not large and small mixed. Select and clean farm-grown seeds ready for next season's planting. Label the bags with name and weight of contents. Build a proper

shed for your seed potatoes. Sort over seed potatoes in store and remove any diseased or rotten Green oat or barley fodder on wet vleis, or under irrigation, will become ready for cutting. Press on with ploughing and cross-ploughing. Decide what crops are to be grown next season, and, if you think fit, discuss the matter with officers of the Department of Agriculture. If you have not already effected all your purchases, consider the question of what seed you will require to buy for next season. If in doubt, consult the Department of Agriculture. In frost-free situations, potatoes can be planted for an early crop under irrigation or on damp land. Cart and spread your farmyard manure and plough it under as soon as spread to avoid loss. If you have any long stable manure, apply it to your heaviest land. The application of fertilisers to the land can continue. If you do not already have one, put up an implement shed, even if it be only poles and grass. Keep wagons and Scotch carts under a similar shed or in the shade of trees. Speed up the making and burning of bricks if this is still in progress.

SEPTEMBER.

Prepare your compost heaps. Utilise your labour to the fullest extent for stumping and clearing more land for mixed crops and for general farm development. Do not be satisfied unless each year sees more profit-earning development work effected. Good organisation of the farm work will permit of much being done without great cost. Begin marking out holes for hand check-row planting of maize, and apply manure or fertiliser. Fertilisers which are to be broadcast and ploughed or harrowed in can be applied Lands which have been green manured in March or April will require a second ploughing about this date or before being seeded. Danger from frost should be past now, and crops susceptible to frost, such as potatoes, onions in beds for the summer crop and Jerusalem artichokes, may be planted where lands are moist. Pumpkins and early maize may be planted in vlei lands Edible canna may be planted "dry" during the latter half of this month Overhaul all implements and replace worn parts. Putting this off till the planting season may mean serious loss of planting opportunities Ploughing and cross-ploughing should be hurried on; also the ploughing under of farmyard manure. Make every effort to secure as good a seed bed as possible; good seed beds mean good stands, and good stands are all important in securing good yields

OCTOBER

Prepare your compost heaps for the rains If not already attended to, overhaul all farming implements and replace worn parts to ensure efficiency Shell ground nuts required for the season's planting. Ploughing of old lands should, at latest, be finished this month If seed potatoes will not keep in good condition until next month, they may be planted now, but they must be planted deep. Edible canna may be planted this month before rain falls Also velvet beans, dolichos beans and sunnhemp towards the end of the month for green manuring. Harvest winter cereals and plough under the stubbles as soon as possible after harvest. When rains have fallen, use every effort to improve the tilth of the lands which will be the first to be planted. On cloddy lands already ploughed, seize the opportunity to break down the clods by disc and drag harrowing as showers of rain fall A spiked roller is very useful for this work. A good tilth means good planting, and a good stand of maize

When necessary, keep the harrows going to check early weed growth Clean lands at this time of year are an insurance against cutworm and other insect pests. If weather conditions permit, plant a trap crop of maize to attract the stalk borer. New land to be ploughed and intended for planting this season should be cleared of heavy grass or weeds by burning or cutting to ensure good work being done by the ploughs. Seasonal showers of rain are liable to spoil bricks unburned. See that bricks which have been made are protected from rain. Clean out guttering and down-spouts of house and farm buildings. Press on with development work so as to have this completed before rains break.

VETERINARY.

OCTOBER-DECEMBER

The first rains may be expected during this period, and due to heat and moisture tick life will become active and cases of redwater and gall-sickness and other tick-borne diseases may be expected. Occasional horse-sickness may occur during December. Vegetable poisoning may still be in evidence unless grazing becomes good.

An Improved Implement for use in Compost-making.

By J. D. Scott, in *Farming in South Africa.*

This article is republished as it is thought it would be of interest to many farmers now making kraal compost.

In the making of compost at the Estcourt and Tabamhlope stations, all dry stock are fed in kraals during the winter to afford them maximum protection against cold. A fresh layer of bedding is added to the kraals each week or whenever required until, by the end of winter, a mixture of grass, dung and urine to a depth of a couple of feet is obtained. This is not touched during the winter as temperatures are too low and there is not enough moisture for much bacterial action.

At the end of winter the cattle return to the veld and, after the bedding in the kraals has been wetted thoroughly by rain, it is built up into heaps about 4 feet 6 inches high varying in width from 12 to 18 feet and in length from 25 to 60 feet. The removal of the material from the floor of the kraal has always been an expensive process. Turning by means of a plough has resulted in continual packing in front of the plough, and a dam scoop has always jumped. As a result the material has had to be removed by hand labour with forks and wheelbarrows which is slow and expensive.

This season an improvement to a dam scoop was tried with excellent results. Four iron bands 2 inches wide and ½ inch thick, sharpened to a point, were riveted under a dam scoop so that the two middle ones projected about 11¾ inches and the two outer ones 10 inches in front of the scoop, being just clear of the inside of the draw-bar. In addition to the rivets, the front edge of the scoop was welded to the bars so that there was no chance of material working between the bars and the scoop.

These sharpened bars penetrated the mixture on the kraal floor easily and it was possible for two boys to remove all the material, with two oxen drawing the dam scoop. As the passage of the oxen over a heap would have consolidated it too much, the compost material was dumped outside the kraal where two other boys packed it into the heaps.

This improved implement has cut down the cost of compost-making at Estcourt enormously. Two boys with two big oxen in this scoop took the compost material out of the kraal at the rate of just under 19 tons per day (1 cu. yd. at 70 per cent. moisture weighs approximately ½ ton) and, with two boys packing it into heaps, it was possible to build a stack 25 ft. x 18 ft. x 4½ ft. high in two days.

The cost of effecting these improvements to the scoop (at the present high price of iron) is only a matter of about £2 10s., and this amount is easily saved in labour within the first few days. The bands riveted underneath act as shoes, taking all the wear and thus adding considerably to the life of the scoop.

Fig 1.—View of under-side of scoop, showing how the iron bars are riveted on.

Fig 2.—View of scoop from above, showing the position of the bars in relation to the draw-bar. Note welding of edge of scoop to the bars.

Southern Rhodesia Veterinary Report.

JUNE, 1942.

Diseases.—Anthrax was diagnosed on Liebig's Ranch, in the Gwanda district.

Tuberculin Test.—Seven bulls, 30 cows and 30 heifers were tested on importation. Two cows from Maitland, Cape, reacted to the test and were destroyed. Two doubtful reactors are held for re-testing.

Mallein Test.—Twenty-nine horses, 16 mules and one donkey were tested on importation with negative results.

IMPORTATIONS.

Union of South Africa.—Bulls 10, cows 30, heifers 30, horses 25, mules 16, donkey 1, sheep 779.

Bechuanaland Protectorate.—Slaughter cattle 182, sheep 330.

EXPORTATIONS.

Northern Rhodesia.—Bulls 4, horses 5, sheep 224.

Portuguese East Africa.—Bulls 3, cows and calves 38, slaughter cattle 120, sheep and goats 42.

EXPORTATIONS—MISCELLANEOUS.
In Cold Storage.

United Kingdom.—Beef quarters 814, sausages 2,301 lbs.

Northern Rhodesia.—Beef carcases 425, mutton carcases 134, pork carcases 21, veal carcases 7, offal 11,250 lbs.

Belgian Congo.—Beef carcases 325, mutton carcases 52, veal carcases 8, offal 1,705 lbs.

Meat Products from Liebigs (Rhodesia) Ltd. Factory, West Nicholson.

Union of South Africa.—Corned beef 37,800 lbs., tongues 36 lbs., assorted sausages 17,397 lbs., assorted lunch rolls 3,509 lbs., meat extract 6,722 lbs.

Northern Rhodesia.—Corned beef 171,000 lbs., beef fat 51 lbs., assorted sausages 4,128 lbs., assorted lunch rolls 273 lbs.

Nyasaland.—Corned beef 143,460 lbs.

B. A. MYHILL,
Chief Veterinary Surgeon.

Rhodesian Milk Records.

SEMI-OFFICIAL. COMPLETED LACTATIONS.

Name of Cow.	Breed.	Age.	Milk in lbs	B. Fat in lbs.	Average % B. Fat.	No. of Days.	Name and Address of Owner
Ajax	G. Guernsey	3 years	5050.50	203.33	4.03	296	W. D. Haywood, Ordoff Farm, Gatooma.
Violet	G South Devon	Mature	4184.00	215.62	5.15	268	C. D L. Morant, Box 741, Salisbury
Maisie	G. Ayrshire	4 years	6361.00	233.14	3.67	300	
Osra	G. Ayrshire	3 years	6620.50	260.84	3.94	300	
Nancy	G Ayrshire	2 years	5635.00	240.61	4.27	300	
Marigold	G Ayrshire	4 years	5828.00	256.95	4.41	300	
Paradise	G Friesland	Mature	7109.20	237.01	3.33	300	Messrs. Red Valley Estate, Marandellas
Pyjamas	G. Friesland	Mature	7513.30	258.06	3.43	300	
Putney	G. Friesland	Mature	4937.40	233.91	4.74	300	
Plough	G. Friesland	Mature	5155.60	209.11	4.06	300	
Pantaloon	G Friesland	Mature	5930.90	212.26	3.58	300	
Oil	G. Friesland	3 years	7371.00	240.61	3.27	300	
Chimite	G Friesland	Mature	6511.30	227.51	3.49	297	J A. Baxter, Glen Norah, Salisbury.
Hanley	G. Friesland	Mature	6305.70	239.02	3.80	300	
Susie	G. Jersey	Mature	7363.40	254.41	3.46	297	
Billie Boy	G Friesland	Mature	7545.00	248.24	3.29	300	
Soap	G. Friesland	4 years	5343.60	220.62	4.11	267	
Sinoia	G Friesland	Mature	6265.60	233.39	3.72	300	
Mother	G Friesland	Mature	7062.10	257.76	3.65	291	
Leggate	G. Friesland	Mature	7243.80	232.44	3.21	277	
July	G. Friesland	Mature	5758.90	255.82	4.44	257	
Moffat	G Friesland	3 years	7311.50	229.60	3.14	300	
Black	G. Friesland	4 years	8302.20	253.36	3.05	279	
Elizabeth	G. Friesland	3 years	7014.90	254.06	3.62	264	
Oranges	G. Friesland	4 years	5759.50	225.05	3.33	300	
Light	G. Friesland	Mature	7398.60	229.95	3.18	300	
Mount Darwin	G Friesland	Mature	6549.20	208.46	3.18	300	
Town	G. Friesland	4 years	4862.60	205.53	4.23	243	S. Moore, Box 999, Salisbury
Betty	G. Friesland	Mature	5661.50	206.23	3.64	257	
Snowflake II	G. Friesland	Mature	7095.60	279.93	3.95	300	
Punch	G. Friesland	Mature	6558.40	223.59	3.41	300	
Beatrice	G. Friesland	Mature	5717.90	204.30	3.57	254	
Mousey	G Friesland	Mature	7352.80	361.69	4.92	300	
Ray	G. Friesland	Mature	6003.20	210.90	3.51	270	
Skofmuch II	G. Friesland	Mature	5663.80	217.88	3.85	263	

Gilston Joan	G. Red Poll .	4 years	4998.00	202.32	4.05	300	
Gilston Placid ..	G. Red Poll	Mature	5448.90	221.60	4.07	300	G. N. Fleming, Box 688, Salisbury.
Ounooi I	G. Friesland	Mature	7171.80	293.54	4.09	295	
Kalulu	G. Friesland .. .	Mature	6211 70	304 20	3.70	300	D. J. Huddy, Granville, Salisbury
No. 4	G. Friesland	4 years	5620.10	218.39	3.89	259	
Ndakata	L R. Shorthorn ..	Mature	4802 00	232 47	4.84	259	
Gladys	L.R. Shorthorn ..	Mature	5792.50	234.92	4.06	244	G R Morris, Box 1040, Salisbury.
Gracie	G. Guernsey	Mature	4660.50	214.64	4 61	262	
No. A 72 . .	G Friesland	3 years	7191.60	232.14	3.23	300	
No. A 4	G. Friesland	Mature	8524 80	254 31	2 98	300	H. A Day, Box 1153, Salisbury.
No. A 11	G Friesland	Mature	7060.50	211.01	2.99	300	
No. 3	G. Friesland . ..	4 years	7732 00	275 16	3.56	300	
No. 80	G Friesland	4 years	5304 60	216.59	4.08	300	
No. A 30	G Friesland ..	Mature	7268 60	265.67	3.66	300	
No. 41	G Friesland .	Mature	6214 70	205 44	3.31	300	
No. A 60	G Friesland	Mature	7663 60	290.02	3.78	300	
No. A 47	G Friesland . .	Mature	7484.50	244.87	3.27	300	
No. 56	G. Friesland . .	Mature	5890 80	230.34	3.91	276	
No. P 97	G Friesland	4 years	5602 40	248.80	4.44	300	
No. 19	G. Friesland . .	Mature	7149 10	246.07	3.36	300	
No. 6	G Friesland . .	Mature	5420 10	200 32	3.70	290	Hon. G. Huggins, Box 671, Salisbury
Bunty	G. Friesland	Mature	9741.50	330 44	3.08	300	
Wendy II	G. Friesland .	3 years	6362.20	219 72	3.45	300	W. Sole, Bauhinia, Glendale.
Hester	G. Friesland .	Mature	8040 50	270 82	3 36	300	
Bud	G Friesland .	3 years	8190 30	296.25	3 50	300	
Emma . . .	G Friesland	Mature	8336.00	316.41	3.81	300	
Marikop	G. Red Poll	Mature	5713 80	221 41	3.88	300	J G Thurlow, Atherstone, Bindura
Dorika . . .	G Friesland .	3 years	6033 20	248 61	4.12	300	
Juno	G Red Poll	Mature	4589.50	201.49	4 39	300	
Dewdrop	G. Friesland .	Mature	7240 00	227.68	3.14	300	
Gracie Fields	G Friesland	Mature	7518 50	257.22	3.42	300	V A Lawrence, Knockmaroon, Norton
Zelesa .	G. Friesland	3 years	7653 40	261.93	3 42	300	W F H Scutt, Maple Leaf, Norton
Loda	G Friesland	3 years	6700.60	298 16	4.30	287	
Fersey .. .	G. Red Poll	3 years	5461.10	251 97	4.61	267	
Angelo ..	G. Friesland .	2 years	5789.40	208.58	3.60	300	
Maranda	G. Shorthorn	Mature	6373 70	265 98	4 17	300	
Vutsigana	G. Guernsey .	Mature	7742 00	303.86	3 92	300	J R Bedford, Poltimore, Marandellas
Twinkle	G. Friesland	Mature	11288 50	388.54	3 44	300	
Pansey	G Shorthorn	Mature	6609 90	234 77	2 55	300	
Betty	G Friesland	3 years	6284 50	213 41	3 40	292	
Bloom .	G Red Poll	Mature	6354.50	243 75	3 84	300	K M Campbell, Hedon, Marandellas
Tiny	G Friesland	Mature	7057 00	277 50	3.93	300	
Baby	G. Friesland ..	Mature	5987 00	208 48	3 48	300	Boyd Clark, Castle Zonga, Inyazura.
Spot III	G. Friesland	Mature	6428 50	237.76	3 70	300	

SEMI-OFFICIAL.—(Continued).

Name of Cow.	Breed	Age	Milk in lbs.	B. Fat in lbs.	Average % B. Fat.	No. of Days.	Name and Address of Owner.
Rusape I	G. Ayrshire	Mature	5891.00	264.89	4.50	238	W. E. Tapson, Lesape Falls, Rusape.
Motorbike	G. Ayrshire	Mature	6210.30	231.52	3.73	289	
England	G. Ayrshire	Mature	6140.30	278.12	4.53	263	
Donkey	G. Ayrshire	3 years	5471.60	224.40	4.10	281	
Girida II	G. Ayrshire	Mature	5922.30	232.99	3.93	300	
Manikwe I	G. Friesland	Mature	5713.40	211.63	3.70	287	
Mabuds	G. Friesland	3 years	6870.20	256.31	3.73	300	
Myriam I	G. Friesland	Mature	7518.10	314.68	4.19	300	
T.B. 56	G. Red Poll	Mature	5617.00	216.09	3.84	280	A. M. Tredgold, P.B. 61L, Bulawayo.
Bawdsey Pear	P.B. Red Poll	Mature	7005.90	267.81	3.82	300	
No. 13	G. Red Poll	Mature	5976.30	261.22	4.37	300	
No. 8	G. Red Poll	Mature	7369.00	272.25	3.69	300	
No. 65	G. Red Poll	Mature	4479.00	226.70	5.06	300	
Spring Creek Mary	P.B. Red Poll	Mature	6353.00	214.28	3.38	300	
L. 4	G. Red Poll	Mature	4977.00	241.82	4.86	300	
No. 9	G. Red Poll	Mature	8613.50	344.70	4.00	300	
Whinburn Dew	App. Friesland	3 years	6529.10	231.05	3.54	300	R. R. Sharp, Whinburn, Redbank.
Whinburn Princess	P.B. Friesland	4 years	7058.90	258.89	3.67	300	
Whinburn Frolic	G. Friesland	Mature	5556.20	218.02	3.92	300	
Whinburn Haze	G. Friesland	3 years	5837.90	208.17	3.57	284	
Una	G. Friesland	3 years	6971.90	248.75	3.57	300	Hon. H. Gibbs, Bonisa, Redbank.
Julia	G. Friesland	Mature	5539.00	217.66	3.95	300	
No. 184	G. Red Poll	2 years	5922.90	215.91	3.65	300	Rhodes Matopo Estate, P.B. 19K, Bulawayo.
No. 121	G. Red Poll	3 years	5522.40	218.83	3.96	287	
No. 118	G. Red Poll	4 years	6117.30	267.63	4.37	300	
No. 94	G. Red Poll	Mature	8159.20	383.14	4.70	300	
Kate	G. Friesland	Mature	6528.00	267.23	4.09	289	W. L. Tongue, Box 199, Bulawayo.
Kelpie	G. Friesland	Mature	10316.00	324.11	3.14	289	
Yvette	G. Friesland	Mature	6862.00	250.39	3.65	300	
Carnation	G. Friesland	2 years	6030.50	218.66	3.63	300	P. Freeland, Lingfield, Gwelo.
No. A 9	G. Friesland	Mature	7005.90	228.77	3.27	300	
July	G. Friesland	Mature	6981.70	224.38	3.21	300	
Enkeldoorn	G. Friesland	Mature	5139.00	213.14	4.15	282	
No. A 7	G. Friesland	Mature	8635.20	268.28	3.11	300	
Maggie	G. Friesland	3 years	6668.20	207.49	3.11	300	

No. 182	G. Friesland	Mature	8523 90	288.93	3.39	285	A Stokes, Safago, Gwelo.
No. 193	G Friesland	Mature	8350 40	265 99	3 19	258	
Bluebell	G Friesland	Mature	8061.10	306 95	3 81	300	
No 305	Guern. Friesland	3 years	6152 50	250 48	4.07	273	
No. 325	Guern. Friesland	3 years	5398 20	204 01	3 79	300	
Valeries Natalie of Shanks	P.B Guernsey	Mature	7489 10	389 62	5 20	300	
Valeries Mona of Delectus	P.B. Guernsey	Mature	6447 60	258 29	4.01	300	
Stella II	G Friesland	4 years	6716 90	239 64	3 57	284	T Cousins, Oaklands, Gwelo
May	G Friesland	3 years	9229 10	300 16	3 25	283	
Topaz	G. Guernsey	3 years	6566 70	222 37	3.39	300	W. D Haywood, Ordoff Farm, Gatooma
Pineapple	G Guernsey	4 years	5959 00	226 81	3 81	285	
No 7	G Friesland	Mature	7718 00	266 06	3 36	289	F B Morrisby, Sunnyside, Gwelo.
No. 40	G Friesland	Mature	9444 00	276 05	2.90	200	
No. 67	G Friesland	Mature	7410 00	237 23	3 20	280	
Jennifer	G Friesland	Mature	7022 00	228 35	3 20	250	
No 4/7	P B. Friesland	4 years	9219.00	310 40	3 37	300	Meikle Bros, Leachdale, Shangani
No. 20/8	P B. Friesland	2 years	7268 00	282 98	3 89	300	
No. 53	P B. Friesland	Mature	9022 00	355 31	3 94	300	
No 21/7	P B Friesland	4 years	7051 00	249 66	3 54	281	
No. 1/8	P.B. Friesland	3 years	10372 00	313 32	3.02	294	
No. 26/7	P B. Friesland	4 years	8503 00	308 00	3 62	300	
No. 8/8	P.B. Friesland	3 years	9470 00	308 25	3.25	300	
No. 9/7	P B. Friesland	4 years	9391 00	300 10	3 20	300	
No. 1/7	G Friesland	4 years	5635 00	215 45	3 82	300	
No 29/7	G Friesland	4 years	7937 00	275.90	3 48	300	
No. 23/7	G Friesland	4 years	8275 00	283 92	3.43	300	
No. 358	P B. Friesland	Mature	7624 00	261 48	3 43	258	
No 220	G. Friesland	Mature	5817.00	210 86	3 63	300	
No 8/8	G Friesland	3 years	8104 00	301 44	3 72	300	
No. 215	G Friesland	Mature	6529 00	221 26	3 39	249	
No. 17/7	G Friesland	3 years	9330 00	313 41	3 36	300	
No 9/8	G Friesland	2 years	7100 00	264 24	3 72	300	
No 21/8	G. Friesland	3 years	8732 00	337 46	3 86	300	

SOUTHERN RHODESIA
Locust Invasion, 1932-42.

Monthly Report No. 116. July, 1942.

Three flying swarms of the Red Locust (*Nomadacris septemfasciata*, Serv.) were reported during the month, one each from the Wankie, Makoni and Chibi districts.

No damage to crops was reported.

No reports have been received since the 18th July.

J. K. CHORLEY,
Acting Chief Entomologist.

THE RHODESIA
Agricultural Journal

Vol. XXXIX.] No. 6 [November - December, 1942

Editorial

Notes and Comments

Food Production Committee—Factual Background No. 23.

Elsewhere in this Journal some interesting notes will be found concerning British war agriculture. These notes should be an additional incentive to Rhodesians to carry on the good work they are already doing.

Soil Erosion: Storm Water Drainage.

This all important problem is too often disregarded with the result that a tremendous amount of damage is done to land. A notice, regarding the above, issued by the Natural Resources Board, appears in this issue.

New Machines for Britain's Harvest.

It gave us real pleasure to learn of Britain's bumper harvest this year, and in this connection an article entitled "New Machines for Britain's Harvest" has been received from the Industrial Publicity Unit, Moubray House, London, and is reproduced in this issue.

Hybridization.

How often agriculturists and horticulturists dream of the marvellous results there would be if it were not for plant diseases.

Much work, however, has been and is being done to control diseases of crops, and valuable accounts of many achievements appear in an article entitled "Disease-Resistant Plants," by F. T. Brooks, in the July, 1942 issue of "Endeavour." The following are some of the points mentioned in his paper.

Chemists have played a most important part in the control of plant diseases, especially in the prevention of foliage and fruit diseases, by spraying and dusting plants with fungicides, and treat-

ing seeds to destroy seed-borne diseases. There are, however, large groups of diseases which cannot be readily controlled by chemical means, e.g., rust fungi and diseases contracted through the soil.

Nature, however, provides a means of controlling or lessening these diseases. There are varieties of practically all crop plants of which some may be very susceptible to disease and others resistant or immune to that disease. Susceptible varieties may give a heavy yield especially during a season when disease is not prevalent, while many resistant varieties may give poor yields. By judicious hybridization varieties can be bred which combine the characteristics of good yields with good disease resisting qualities.

The greatest discovery in plant breeding was made by Gregor Mendel, an abbot of the monastery at Brun in Czechoslovakia. The results of his observations were first published in an obscure periodical in 1866. Somehow his paper was overlooked and this paper on the laws of heredity in plants was not rediscovered until 1900.

Mendel who experimented with different races of garden peas showed that certain characteristics such as stature of plant and colour of flowers were transmitted in the progeny according to definite laws. Further it was clear that hybrids established between races differing in two characters gave some progeny showing different combinations and characters from these in the original parent.

Much valuable work has been done in the breeding of wheats in Australia. William J. Farrer from 1886 set about the breeding of wheats in Australia to resist rust attack, and the varieties of wheat now grown in that country are chiefly derivatives of those which Farrer produced. Between 1890 and 1920 wheat production in Australia increased from 27 million bushels to 144 million bushels, and this was largely due to the introduction of varieties created by Farrer.

Research has resulted in advances being made by the plant breeder with such other crops as potatoes, tomatoes, bananas and cocoa. Nor is the flower gardener overlooked in these researches. For example, there have been notable advances towards the production of rust-resistant antirrhinums.

Economic Value of Plants.

The common Stinging Nettle (*Urtica dioica*) found in Great Britain was very much used during the last war both by Great Britain and Germany and is also being used in the present war. The bast fibres are very strong and are composed of a very pure form of cellulose. They are used in the manufacture of textiles and also in paper making. Use can be made of the chlorophyll, while the leaves are rich in feeding value and can be fed to cattle.

Here in Rhodesia our two main fibre crops from an economic point of view are sisal, which is grown chiefly in the Sabi Valley, and sunnhemp, which can be grown practically all over Rhodesia. Up to the present the drawback about sunnhemp has been the difficulty in extracting the fibre, but this has now been overcome

by the invention of a new machine made in Rhodesia, and it is hoped that in the near future sunnhemp will form a profitable industry in the Colony.

Another plant of great economic importance at present is stramonium (*Datura stramonium* and *D. tatula*). A full description of these plants was given in an article in the last issue of this Journal and in the present issue a note will be found on the marketing of stramonium. This plant contains the alkaloid Atropine, which is used as a nerve stimulant and also for the relief of asthma. Supplies are very short in Britain, and South Africa is sending large quantities overseas. Rhodesia is also playing her part in the collection of this important plant, and with the help promised by the various Women's Institutes it is hoped that appreciable quantities will be collected in the Colony for shipment overseas.

The yellow flowered poisonous shrub *Thevetia neriifolia* is familiar to most of us, and is often found as an ornamental shrub in gardens. It has been found that the kernels of this shrub contain a powerful insecticide. The kernels are ground and soaked in water for about 24 hours, filtered and a little soft soap added to the filtrate. The resulting solution was found to be very effective against various insects such as aphids. A concentration of ¼ to ½ oz. of kernel per gallon of water was found to be satisfactory.

Finally, as we are aware, citrus fruits are scarce at home and a substitute for these has been found in parsley. It has been proved that parsley is very rich in Vitamin C—the Vitamin which prevents scurvy, and that parsley can take the place of citrus fruits. A so-called " lemonade " can be made from parsley.

Acknowledgements.

In the compilation of these notes on " Economic Value of Plants " reference has been made to the following: "Nature," July 18, 1942; " Review of Applied Entomology," Vol. 30, Part 6, June, 1942; and " South Africa," July 18, 1942.

Dried Foods.

As dried foods are playing an ever increasing part in war economy a few notes extracted from a recent issue of " Nature " will not come amiss.

At a meeting of the Nutrition Society and Society of Chemical Industry held in the Great Hall of the British Medical Association on July 25th, a series of papers was devoted to giving an account of the results recently achieved in improving the quality of dried foods.

When foods have to be transported, particularly by sea under war conditions, their dehydration is of special importance. It is estimated that in peace time Britain imported annually some three million tons of water with foodstuffs.

In general it could be said that the nutritive quality and palatability of dried foods such as meat, fish, milk, eggs and vegetables would equal those preserved by the established processes of canning and refrigeration.

Briefly the main principles to be observed are the destruction of enzymes, the maintenance of a low water content, exclusion of oxygen or retarding of oxidative changes and avoidance of contamination with traces of metal, and, in addition, avoidance of excessive temperatures during drying, drying carried out as quickly as possible, avoidance of temperatures at which bacteria flourish, and careful selection and handling during manufacture.

As an illustration of the economy in space it was stated that the requirements of a normal diet would be reduced to a quarter of its weight and volume.

Mention is made of the drying of meat in the form of a mince which for storage and distribution is compressed into blocks and packed in air-tight cans.

Reference is also made to the successful treatment of eggs, fish and vegetables.

For example in the process of drying cabbage, carrots and potatoes, a heat treatment must be given before drying is carried out, and for the protection of the ascorbic acid a small amount of sulphite added to the scalding liquor is beneficial. While storage of the dried product in air but at low water content is possible for reasonable periods with cabbage and potato, carrot should be stored in an atmosphere free from oxygen, owing to the destruction of carotene by oxygen.

The importance of dried foods is appreciated in this Colony, and a drying station for vegetables has been established at the Government Experiment Station, Hillside. When all the necessary equipment has been obtained it is hoped that all kinds of vegetables and possibly certain kinds of fruits will be dried.

Sweating Sickness of Cattle.

A letter was received by the Department of Agriculture from Mr. Austen Jackson, Fort Victoria, concerning the use of blue in sweating sickness. He says he has had considerable experience in treating sick cattle by this method, and has had excellent results.

Advice has been received from the Veterinary Department that the cure referred to by Mr. Jackson is well known to that Department, but explained that although many animals have recovered after its use it is doubtful whether these represent a bigger percentage than ordinary natural recoveries.

Turkish Tobacco.

Prospective growers of Turkish type tobacco are invited to send in their names and addresses to the Department of Agriculture, in order that a complete list may be compiled. The Department will make all possible arrangements to assist new growers with the necessary technical advice.

Food Production Committee.

FACTUAL BACKGROUND No. 23

Issued by the Minister of Information of the United Kingdom.

Linked to the Minister of Agriculture's speech in the House of Commons this week and on the eve of the harvest, the following facts regarding British war agriculture may supply news items and commentaries demonstrating three points:—

(a) The magnificent achievement of British agriculture, like all other parts of the British home front in mobilisation for total war.

(b) The efficiency, modernity and high quality technique of British agriculture, a good example of how Britain's industries are among the most progressive in the world.

(c) The saving of huge shipping tonnage by the increase of home-grown food, thereby releasing ships for offensive military action.

The total area of Great Britian is 55 million acres. Before the war, 12,000,000 acres were under the plough. To-day 18,000,000 (33 per cent. of the total area of the country). Before the war Britain produced only one-third of her food requirements, to-day, by immense self-sacrifice by farmers and technical efficiency, two-thirds of the entire food requirements are being produced with practically no extra labour. What makes this even more remarkable is the fact that it has been achieved while a great dilution of farm labour has been going, due to the call-up, and its replacement with female, juvenile and aged labour, etc.

Britain to-day is self-supporting in potatoes, with a 60 per cent. output increase in 1939-41, and still more this year. Vegetables, 2,500,000 tons in 1938, 4,000,000 tons in 1941. The curve is still rising rapidly. The wheat acreage increased by one-third in 1941 over the pre-war period, by half in 1942, and the increase will be 80 per cent by 1943. Oats, 2,500,000 tons to 4,000,000 tons. At the same time, in spite of the immense increase in arable land and the reduction in pastures, the milk yield for the first six-months period in 1942 was 10,000,000 gallons greater than in the corresponding period of the three last pre-war years. Allotment owners and home gardens have played a magnificent part in this achievement. Allotments now number 1,750,000, practically double the pre-war figure. These, with two to three million private garden owners, now produce between £10 to £15 million worth of vegetables, thus releasing land for crops. By January, 1942, 2,300 co-operative pig clubs were started by the non-farming population, six times as many as the previous year. These clubs produced 7,000 tons of bacon or 100,000,000 breakfasts of two rashers per person.

Especially interesting is the immense development in the mechanisation of British agriculture which has increased the output per man-hour and at the same time increased the intensity of output per acre. To-day Britain is easily the most highly mechanised farming country in Europe. When the war began

Germany had 70,000 tractors for a land area of approximately twice the size of Britain. Britain had 50,000 tractors. By 1941 Britain had 90,000 tractors and to-day well over 100,000, representing more than 100 per cent. increase on pre-war. The most interesting fact is that British farm labour productivity, i.e., the output per man-hours, is at least half as great again as that of Germany. It is interesting also that while mechanisation in Australia, the Argentine and the United States has gone with a comparatively low yield per acre, in Britain mechanisation has been achieved while keeping the yield per acre easily the highest in the whole world. For example, the average yield of wheat per acre in Britain to-day is 34 bushels, compared with America's 13 to 14. In many areas, for example on the Hampshire downlands, land never previously beneath the plough is to-day yielding over 40 bushels of wheat per acre. The yield of oats is often 80 bushels and over per acre.

This is a tribute to the immensely scientific approach of British farmers to the use of organic and inorganic fertilisers. At the same time fertilisers previously imported are now being produced in Britain. For example, 20 new plants were producing lime by the end of 1941. There has also been an immense expansion in home nitrate production. Practically the only imported fertilisers used in new areas under wheats is potash. Some idea of the part British farmers are playing in defeating U-boat warfare is gained from the fact that newly-sown land yields 40 bushels or over one ton of wheat per acre for a half-hundredweight of imported potash, thus giving a 4,000 per cent. saving in shipping space. In lime fertilisers alone over 2,500,000 tons were applied to the land in the last twelve months, over 100 per cent. greater than in the 12 months before the war.

One aspect of Britain's war effort which is sometimes overlooked is the fact that the whole of Britain is working night and day to make herself a base for offensive action in Western Europe against Hitler. Ruthless and unceasing efforts have been necessary to keep this base in existence against the U-boat menace, and British farmers have played an equally glorious part with the Navy and Merchant Navy in achieving this. The structure of British war agricultural organisations shows again the unrivalled genius for organisation of the British people. The heart of this organisation is the War Agricultural Committees, one for each county, which are responsible for executing the policy of the Ministry of Agriculture. These committees are composed of the best talents among the local landowners, farmers and farmworkers. Each county War Agricultural Committee has an army of state-owned tractors to bring instant help to any part of the farm front where help is needed. Also the county committees have power to take over the land of inefficient farmers and farm themselves. They instruct farmers in the county exactly what to sow. The whole system works with amazing smoothness. The most interesting of all the developments in British farming during the war is the immense mobilisation of science throughout the nation for tackling agricultural problems and the quick application of scientific discoveries right down to the smallest farms in the country. The Agricultural Research Council mobilises all scientists and the Agricultural Improvement Council has the job of seeing that the findings of the former Council are applied swiftly in practice. The Agricultural Improvement Council has a demonstration sub-

committee attached to each county War Agricultural Committee to bring new ideas and methods instantly to the notice of farmers. The County War Agricultural Committee sees that these new methods are tested on different types of farmland in its county. In this way technical revolutions are taking place which is putting England back in the position she occupied in the 18th century as the world's leader in scientific farming. This immense technical development and the organisations carrying it through will almost certainly remain after the war and when agricultural import facilities are opened after the war should ensure that the British population is better nourished than ever before in its history. These demonstration sub-committees are so thorough in their working that they come down to the smallest plots and kitchen gardens in the land, showing improved methods of vegetable production, etc. At the same time land reclamation and drainage (three million acres) and of upland reclamation for pasture in Wales are rapidly being carried out on an immense scale. Also all over the country are training courses to demonstrate the most efficient use and upkeep of new mechanical farm instruments. At the same time there is immense development in the marketing of food. The Ministry of Food buys the complete output of fatstock and some vegetable crops, including potatoes. The milk, of course, is marketed entirely by the Milk Marketing Board. Here we see that British democracy can without sacrificing individual freedom, organise itself for maximum efficiency, an efficiency greater than the boosted efficiency of the totalitarian States, to meet the needs of the twentieth century.

Another interesting development showing the high morale of the British home front is the development in seasonal auxiliary labour—student and schoolboy camps, young farmers' clubs, Women's land clubs, etc. These are voluntary organisations to supply personnel to meet the calls of the county War Agricultural Committees' urgent labour requirements. In addition, note the growth of the Women's Land Army of 40,000. Many thousands of these before the war were in city jobs. One example of the tremendous dynamic war-time developments is seen in drainage. The key machine in modern drainage is the drag line excavator. In the summer of 1940, the Ministry of Agriculture had none. At the end of 1940 there were 21; to-day there are 250, and by the end of 1942 it is estimated that there will be 400. The Ministry of Agriculture itself owns 7,000 tractors. These, as noted above, are mobilised by the county War Agricultural Committees to be rushed wherever they are urgently needed to supplement private tractors.

To complete the picture of the British food situation after three years of war, it is interesting to note that butter to-day is 1s. 7d. per lb., compared with 2s. 6d. at the end of the last war. Cheese is 1s. 1d. per lb., compared with 1s. 8d. at the end of the last war. Dripping is 6d., as compared with 1s. 1d., eggs 2d. as against 5½d., margarine 5d. as compared with 1s., sugar 3d. as compared with 7d.

The whole picture of British farming shows the enormously high morale and rock-like strength of Britain as she enters the fourth year of war, and shows also the high technical efficiency of British industry. Most important of all, the British people as the result of war have found a new youthful outlook and are solving the organisational problems of the twentieth century without sacrificing their democracy.

Soya Beans.

(Continued)

By H. C. Arnold, Manager, Agricultural Experiment Station.

How to Sow.—The drilling machines used for maize and also those for wheat can be adapted for soya beans. In the U.S. of America a large part of the crop is sown with grain drills which place the seed in rows eight inches apart, and about 100 lbs. of seed per acre is usually sown. The spike harrows and rotary hoes subsequently used to weed the crop reduce the stand somewhat. The best distance between rows for Rhodesian conditions has still to be determined. Much depends on the kind of sowing and weeding implements the farmer proposes to use. Experiments conducted in America show that it is almost impossible to reduce the yield by sowing too thickly. Nevertheless in districts in which the normal rainfall is insufficient to produce satisfactory crops of maize, it would be advisable to refrain from sowing too closely. In order that the weeds which appear during the early stages in the growth of the bean crop may be dealt with by means of drag harrows, it is advisable to aim at securing a stand which is dense enough to allow for a number of casualties resulting from the weeding operations.

Distance Planting Trials.—The first series of trials were conducted for three seasons. The distances between rows were 12 inches, 18 inches and 24 inches respectively, and the distance between seeds in the row 4 inches. Twelve blocks of randomised plots were sown. The results obtained in these trials are tabulated below.

Yields of Seed in lbs. per Acre.

Season.	Variety.	Rows 12 ins. apart.	Rows 18 ins. apart.	Rows 24 ins. apart.	Difference between 12 in. and 24 in. spacing.
1938-39 . ..	Mammoth	759	614	627	21%
1939-40	Pot. No.184	1,485	1,408	1,307	14%
1940-41 .. .	Hernon No. 268	1,089	1,054	980	11%

Despite droughty conditions in the season 1940-41, the yield obtained from the 12 inch spacing was slightly heavier than that from the wider spacings, but the difference is seen to be so small that it is doubtful whether such close spacing would be as profitable as wider spacing which would require less seed, and less labour for weeding, etc. The difference in yield in favour of the close spacings has been lessened by the use of the Hernon variety. The robust habit of growth of this type enables it to make better use of the extra soil and air space provided by the wide spacings. The most economical spacing will be one which

is wide enough to allow the operations of seeding and weeding to be expeditiously performed and close enough to produce a heavy yield of seed. Most farmers will wish to use the same implements for their soya beans as they employ for their other crops, and these are usually designed for rows which are at least 30 inches apart (small-grain drills excepted).

The majority of our farmers, therefore, find it is not practicable to sow in rows which are closely spaced, and during the season 1941-42 new trials were commenced which are designed to investigate the effect on yields of reducing the distance between the plants in the rows, when these are 30 inches apart. Spacings and yields obtained during last season are shown in the following tabulation:—

Yields of Seed in lbs. per Acre.

Spacing.	30 in. x 4 in.	30 in. x 2 in.	15 in. x 4 in.
Yield of seed	1,432	1,561	1,593

These results show that when the rows are as far as 30 inches apart the plants should be closely crowded together in the rows, failing which the maximum crop of seed will not be obtained. The variety used in this trial was Hernon No. 107. This is a robust kind suited to wider spacings between rows than the pre-Hernon types. In this trial the yield of the 30 inch x 2 inch spacing was almost as large as that from the 15 inch x 4 inch spacing. This indicates that when the crop is grown on a field scale the wide spacing between rows will probably be found the most economical, provided the plants are not further than 2 inches apart in the rows. At a spacing of 30 inches x 2 inches there will be 104,544 plants per acre. The weight of seed required to produce that number of plants will vary with the size of the beans, but it will usually be between 40 lbs. and 55 lbs.

Depth of Sowing.—It is very important that the seed should be sown neither too shallow nor too deep. If the soil covering is too shallow there is a risk of insufficient moisture in the soil after germination has commenced, causing the death of the seedling. When the seed is placed too far down, the vitality of the seedling may be seriously impaired before it reaches the surface. Under average conditions from one and a half to two inches is the best depth. On light open soils deeper placement may be found advantageous, but on land which forms a hard crust after heavy rain, shallower and heavier seeding and dropping two or three seeds together in hills instead of evenly spacing the seed in a continuous row will help to secure a satisfactory stand. The use of depth regulators attached to the furrow openers, similar to those recommended for cotton planting, may be found necessary on loose soils.

Weeding.—The rate of growth of young soya beans is slower than that of maize, and this makes it imperative that early and effective measures should be taken to destroy the weeds before they compete with the beans for the soil nutrients and moisture. By preparing a good seed-bed and destroying all weed growth at the time of sowing, the necessity for further weeding, until the plants are well above ground, may be avoided. It may then be possible to use weeders or light harrows without seriously

reducing the stand, provided the surface is free from trash left over from the previous crop. Thorough weeding during the early stages of growth is of great importance in order that the crop may quickly outgrow weeds arising from later germinations. After reaching the age of six to eight weeks the beans form a dense canopy which effectively checks weed growth.

Harvesting.—The crop is ready to harvest when the seed has reached the hard-dough stage, and most of the leaves have fallen from the plants. If cut too early, the seed will wrinkle and shrink; both weight and oil percentage will be reduced. The introduction of non-shattering strains enables farmers to leave the crop standing in the field until the leaves are practically all off. Some farmers may be tempted to harvest the seed crop before the leaves fall, thinking that by so doing they can get a better quality of straw—something approaching the quality of hay. There is no period, however, when soya-beans can be cut and produce a crop of good hay and at the same time make a good crop of marketable seed. A hay crop will usually be cut three weeks or a month before the seed crop is ready to harvest. Only when the whole crop is to be used as fodder is there any advantage in cutting it before the seed is mature. The erect habit of growth of the soya bean plants enables them to be reaped with the same kind of machines as are commonly used for wheat. Some kinds have a tendency to form their pods rather too close to the ground to allow the reaping machine to be used without leaving a portion of the seed attached to the stubble. The remedy for this will be the choice of a naturally tall growing variety and favourable soil and cultural conditions. If a hay mowing machine is used, a sufficient number of labourers should be on the field to collect and tie the crop into bundles and move them out of the path of the machine, so as to avoid trampling the beans by the draught animals on the next round. Reaping machines which also bind the crop into bundles could be used to advantage. When such are employed it is advisable to harvest before the stalks and seed are thoroughly dry. When the risk of mildew development is past, these are bunched in shocks or stooks of convenient size and left until they are well dried, after which they may be stacked until it is convenient to thresh them. In America it has been found that machines which combine the operations of reaping and threshing reduce the cost of harvesting to one-half of that incurred when the operations of cutting, binding, stooking, loading, hauling to the stack, and threshing, are performed separately. Manufacturers of many types of threshing machines now supply the equipment needed for effecting the necessary adjustments for threshing soya beans. Local farmers using machines normally built for maize, and at least one type constructed for wheat have given very satisfactory results during the past season.

Ordinary wheat threshers usually handle soya beans satisfactorily if a few adjustments are made. The adjustments necessary depend on the type of machine and the moisture content of the beans. Usually the speed of the cylinder must be reduced to approximately one-half of the normal rate. It may be found necessary to remove the first concave and substitute a wooden blank in order to reduce the proportion of chipped and broken beans. If the beans are damp it may be necessary to use all the concaves, but to remove one-half to two-thirds of the teeth.

Lowering the concaves is usually necessary, particularly if the beans are very dry. It will be found that the adjustment necessary will depend to some extent on the moisture content of the beans and straw, and it will be advantageous to have uniformity of moisture content throughout the material. This can be ensured by stacking the material for a few days before attempting to thresh it. In America it has been found that the common grain threshers gave satisfactory results at a speed of 500 r.p.m. for a cylinder 18 inches in diameter. We are indebted to a local farmer—Mr. Peacocke, of Arcturus—for the information, that he found his Australian-made machine worked best with a cylinder speed of 850 r.p.m. when he threshed his crop straight from the field. It will generally be found necessary to keep the cleaning and elevating parts working at the normal speed by increasing the size of the pulley which drives those parts of the machine.

Growers of small areas will probably reap by hand, and unless the plants have exceptionally strong root systems it will be found less laborious to uproot them than to cut them off above ground; but discretion needs to be exercised before adopting this method. If the texture of the soil allows the plants to be uprooted in clean condition that method will be satisfactory, but if soil adheres to the roots it may be found difficult to prevent it from becoming mixed with the seed, the value of which for milling purposes will then be reduced. In order that the seed may be kept clean and in good condition for edible purposes, cutting the stems above ground level is to be preferred. The stems are tough and well sharpened knives or sickles are required.

COMPARISON OF YIELDS OF SOYA BEANS WITH THOSE OF MAIZE.

Experience in this Colony as well as other countries has shown that in general the soil and climatic conditions required by soya beans are similar to those of maize. Farmers who have land and equipment suitable for maize cultivation will wish to know whether the production of soya beans is likely to prove as profitable as the production of maize. Investigations have been laid down with the object of finding the relative yield of maize and soya beans, but the trials are not complete and will need to continue for some few years before definite conclusions can be reached.

The plots in Crop Rotations F. and H. which were commenced in the season 1919-20, when maize was the principal crop throughout this Colony, were sub-divided in the season 1940-41. On the southern side the old rotations will continue as in the past, but soya beans have been introduced on the northern sub-divisions and in future they will alternate with the maize, in order that the rotational effect of soya beans may be compared with that of maize.

In both of the original rotations three crops of maize were grown in the four-year cycle. The manurial treatment in Rotation F. consists of one dressing of 8 tons of farmyard manure per acre and one of 200 lbs. superphosphate per acre, while in Rotation H. it is one crop of velvet beans ploughed under and two dressings of 200 lbs. each of phosphatic fertiliser per acre. In the season 1940-41, in the new rotation, soya beans for seed were sown in

the place of velvet beans for ploughing under, but after the first season's results it was decided that it was inadvisable to delete green manure from the rotation and, commencing with the season just past, the amended rotation will be maize, soya beans, maize, velvet beans ploughed under for green manure.

The following tabulations show the manurial treatment of each of the plots during the past four years and the yields of maize and/or soya beans obtained during the two seasons just concluded.

ROTATION F.

Manurial Treatments and Yields in Bags (200 lbs.) per Acre.

Seasons.	Plot B.	Plot C.	Plot D.	Plot E.
1938-39	Supers	Sudan	Nil	F.Y.M.
1939-40	F.Y.M.	Supers	Sudan	Nil
1940-41	Nil	F.Y.M.	Supers	Sudan
1941-42	Sudan hay	Nil	F.Y.M.	Supers
1940-41 Old Rot.	Maize 10.53	Maize 10.55	Maize 7.60	Sudan grass
1940-41 New Rot.	Maize 10.73	Soyas 5.76	Maize 8.73	Soyas 4.90
1841-42 New Rot.	Sudan	Maize 10.30	Maize 9.55	Maize 7.10
1941-42 Old Rot.	Soyas 5.93	Maize 11.93	Soyas 4.88	Maize 9.13

F.Y.M.=Farmyard Manure.

Average Yields.

	Maize.		Soya Beans.	
	Season 1940-41.	Season 1941-42.	Season 1940-41.	Season 1941-42.
Old Rotation	9.56	8.98	—	—
New Rotation ..	9.73	10.53	5.33	5.40

Although the number of replications of the treatments in these trials is fewer than is considered necessary to obtain a high degree of accuracy, it may be claimed that the yields of maize obtained this season indicate that the maize crop benefited from the residue of the soya bean crop grown on the same land last season. This beneficial effect was also reflected in the vegetative growth of the maize, which was deeper green in colour and the stalks were thicker and taller. It may be noted also that in both seasons the yield of soya beans on this land was approximately half as many bags per acre as the yield of maize.

Owing to the alterations made in Rotation H., it is not possible to draw valid conclusions from the results obtained so far.

In the fertiliser and kraal manure trials cited above, maize, Hernon No. 107 soya beans and Somerset sunnhemp were sown across the various manurial dressings which occupy fifty plots in all. The average yields per acre over all the plots were as follows:—

Maise 2,645 lbs. Soya beans 1,207 lbs. Sunnhemp 825 lbs.
In this case, therefore, the yield of the soya beans was 45% of that of the maize.

Farmers assert that the cost per acre of growing and harvesting soya beans is about equal to that of growing maize, but there are other factors which favour the beans, e.g., they leave a residue which is beneficial to the next crop; they can be reaped and marketed earlier in the season; the land can be cleared and ploughed early; fewer grain bags and less transport are required for marketing a crop of the same value; the threshed straw has a higher feeding value; the seed is not attacked by weevils and can be stored in open bins.

Market Prospects.—The many ways in which soya beans can be used are now well known to most farmers in this Colony. The ease with which they can be transported and stored suggests that an outlet for any surplus which might be produced would not be diffifficult to find. In general, however, they can only be used for industrial purposes when supplies are plentiful and cheap. Their market value in the immediate future will be governed largely by the extent to which they are used to replace more expensive foodstuffs, e.g., meat, wheaten flour, etc. If the crop is not fully utilised for such purposes, its market value will be governed by the prices paid for other agricultural products with similar industrial uses, e.g., cotton seed, ground nuts, etc. If it is found that soya beans can be grown more economically than ground nuts, they are likely to replace that crop to a large extent in our local industries and several thousands of bags will be required annually.

A local manufacturing firm offered to enter into a contract to purchase the 1941-42 crop at 16s. per bag of 200 lbs. provided the producers would form themselves into a pool to be operated by the Farmers' Co-op., Salisbury. In order to give the material a reasonable trial a minimum of 3,000 bags was required, and to encourage production the Government, for a period of three years from January 1st, 1942, has offered to contribute a subsidy not exceeding four shillings a bag in order to raise the price to the producer to £1 per bag. This offer will apply to beans of good quality used for industrial purposes only.

The general shortage of foodstuffs prevailing at the present time has increased values, and the price of commercial beans of good quality is now considerably more than £1 per 200 lbs.

METHODS OF USING AND NUTRITIVE VALUE.

It is self-evident that soya bean production will not flourish unless ways and means of utilising the beans are found, and for this reason every grower should acquaint himself with their merits and make use of them on his own farm to the fullest possible extent in so far as it is economical to do so. Many farmers are now using them daily for culinary purposes. Soya bean meal can be used to replace 20% of wheaten flour in home-made bread, cakes, scones, etc. These beans should form a part of the regular diet of all native employees on farms. When the farm natives have acquired a liking for them, their use will spread to the towns, mines, etc., and the local market will thus be increased.

The merits of soya beans as food for humans particularly as a substitute for eggs and meat because their proteins resemble those of animal origin are being increasingly recognised, and

there is every reason to think that they will be welcomed in European countries as soon as hostilities cease, or even before. One bag of soya beans contains as much protein and oil as four bags of maize, so that one ship loaded with soya beans could carry as much of those essential nutrients as four ships loaded with maize.

There is little likelihood of a surplus above local requirements being produced in the near future.

The local factories are using the oil for the manufacture of soap. The oil can also be used for several other purposes including cooking and in the manufacture of paint.

A report recently received states that experiments conducted in the U.S. of America have shown that it can at least replace a part of the more expensive linseed oil which is normally used. Exposure tests showed that exterior paints made from blends of soya bean and other oils were as durable and sometimes more durable than straight linseed oil paints. Paint in which 100% soya bean oil was utilised tested against a similar linseed oil paint for drying, brushing, flowing and other qualities, was considered equal to the linseed paint except for being somewhat slower drying. Panels which received three coats of soya paint remained in good condition after four years exposure to weather. Slow drying oils last longer than quick dryers because they do not harden, crack and break down (due to oxidation) as quickly. Soya bean oil has some good qualities such as freedom from yellowing and elasticity which make it a desirable oil for use in paint. It is thought that it will enter more and more into paint manufacture in future.

In the U.S. of America large quantities of soya bean flour are used in the confectionery trades, and it is also used by the meat packers as a binding agent in sausages.

When the raw beans are ground into meal, and this is stored, the oil it contains oxidises within a few days, and an unpleasant rancid flavour develops. To avoid this it is necessary to grind a fresh supply every two or three days. When maize is mixed with soya bean in the proportion of 5 to 1 respectively and they are gristed together, the rate of oxidation is much slower, and the mixture may be stored for a few weeks before any marked deterioration takes place. The residue which remains after the oil has been extracted can be milled for use as flour. In this form it can be stored for many months. This flour can be mixed with 75% of wheaten flour for making bread, cakes, etc., and it greatly improves their nutritive qualities.

Patent processes for de-hulling and disembittering the beans have been developed in Europe and America and flours and "grits" which retain the greater part of the oil, can now be manufactured, and such processed foods can be stored for several months. They contain 40% to 50% of protein and 20% of fat when the oil is not extracted, down to 1% of fat when the process is designed to remove the fat from the bean meat.

The manufacturers of these patent flours claim that when 20% of soya flour is mixed with wheaten flour for bread-making great improvement in the nutritive value of the bread is obtained,

and that such bread will retain its freshness for one day longer than can be obtained without the addition of soya flour.

Other claims for the nutritive qualities of soya beans and their processed flours are as follows:—

The protein in 1 lb. of soya beans is equal to that in 2½ lbs. of beef, or 54 eggs, or nearly two gallons of whole milk.

Soya bean flour, properly prepared, retains practically the full food value of the original bean.

Soya bean flour is rich in minerals, rich in high quality protein, rich in fat, and rich in vitamins.

The most expensive foodstuffs are minerals, vitamins, proteins and fats. Soya beans are rich in these and yet relatively cheap.

Soya beans contain a greater concentration of essential food elements necessary for human consumption than any other common food.

Students of human nutrition assert that calcium is one of the elements that is usually deficient in low cost diets. Soya beans are one of the cheapest vegetable sources of calcium known.

Of all the legumes and grains, soya bean flour has the greatest degree of alkalinity. Thorough study of the carbohydrates has revealed that only 2% is starch.

A large proportion of the processed soya bean flour and grits produced in America is used in the manufacture of specially prepared dog foods, some of which are marketed in sealed tins. The similarity of the soya bean proteins to those of flesh foods has enabled the makers of those preparations to offer an efficient substitute for meat in a convenient form at a comparatively low price.

Soya Beans produce more protein per acre than other food crops.—The crops ordinarily grown in this Colony such as maize, kaffir corn, etc., produce large quantities of starchy food materials. Although these are very useful for many purposes, they are not well balanced foods, as they require the addition of proteins and other nutrients. When these other materials have to be purchased they are found to be expensive, and it will usually be more economical to produce them on the farm. The tabulation below shows how soya beans compare with other common farm crops for the production of protein and oil. The protein and oil content given for soya beans is the average amount yielded by nine Hernon strains grown in trials at this Station. The yield of the ground nuts is based on a twenty bag per acre crop of nuts which would yield about 900 lbs. of kernels.

	Yield per acre lbs.	Crude Protein %	Ether Extract Oil %	Crude Protein per acre. lbs.	Oil per acre. lbs.
Soya Bean... ...	1,000	39.8	17.2	398	172
Maize	2,400	9.3	4.7	223	113
Wheat	1,400	11.7	2.0	164	28
Ground Nuts (kernels)	900	30.8	47.1	277	424

Experiments in which various crops for utilisation as hay or as silage were compared at this Station, showed that one of the hay types of soya bean produced an average of 506 lbs. of crude protein per acre over a 5-year period. This amount was exceeded by the velvet bean crop only.

The tabulation shows that in spite of heavier total yields both the wheat and the maize crops produce less protein and oil per acre than soya beans. The acre-yield allowed for ground nuts is heavier than that usually obtained. In spite of this, the ground nuts' protein production is only two-thirds as much as that of the soya beans, though the oil is more than twice as much. The ground nuts are considerably more costly to grow and there is greater risk of their being spoiled either in the field or during storage.

Palatability Trials.—Although soya beans can be used for industrial purposes, it is thought that higher prices will be obtained for the portion of the crop which is used for human consumption. In order to ascertain their relative merits when cooked, some forty different strains have been subjected to cooking tests. It was found that, although all have a "nutty" texture in contrast to the "mushy" texture found in other varieties of beans, some of the Hernon strains, particularly No. 18, had a larger proportion of "soft" beans than the others, and these are definitely "softer" than P. No. 184 and H. No. 107. Soaking all night was found to reduce the period required for boiling, but even after immersion for 24 hours in unheated water when the room temperature was 58° F., nearly all of the strains were found to contain a proportion of seed which were impervious to "cold" water; P. No. 184 with 3% and Hernon No. 39 with 45% were the extremes in this respect.

Imported edible varieties such as Easy-cook, Herman, Hayto, Mammoth and Rokuson were included in these tests and it was found that they were not in any way superior to P. No. 184 and the Hernon strains.

Boiling Hernon soya beans for various periods was also tried. The beans were pre-soaked for 14 hours. The first water was poured off and cold, salted water was added. About fifteen minutes was required to raise the water to boiling point. After boiling for 1¼ hours the beans were found to be cooked, though still somewhat hard. After two hours' boiling some were still hard while others were soft, and another hour's cooking was required to soften the whole lot. Boiling was continued for another hour and by the end of that time several of the beans had split open owing to their skins becoming detached, thus both appearance and flavour were somewhat impaired.

Fairly large quantities of kaffir beans and haricots are used in this Colony in natives' rations. In certain seasons supplies of the former are insufficient to meet market demands and the difficulty of handling the crop makes the seed of the latter expensive. The merits of soya beans as food and the ease with which the crop can be cultivated suggest that the mines and other employers of native labour may eventually purchase large quantities of them. The chief obstacle to be overcome is the innate prejudice which natives have against any new kind of foodstuff. At this Station little difficulty in breaking down this prejudice

was experienced. During the cooking tests several Europeans ate the beans and freely expressed a liking for them. The curiosity of natives employees was thus aroused and they were given some to taste. Next about 5% of soya beans were mixed with their ration of kaffir beans. After the first six weeks the proportion of soyas was gradually increased until at the end of the sixth month the bean ration consisted of soya beans and kaffir beans in equal proportions. A marked change in our native employees attitude toward soya beans is now apparent. Their prejudice against soya beans has vanished and they now eat them parched or toasted as well as boiled. Seeing that soya beans can be cooked in less time than haricot beans it would seem that employers who wish to introduce the former into their natives' rations would have no diffifficulty in breaking down any prejudice they might encounter at first if they commenced by mixing a small proportion with the haricot bean ration.

Green Soya Beans as Vegetables.—Soya beans may be used before they are fully ripe. The pods are too fibrous for human consumption so they cannot be used in the way the common garden or kidney bean is used. The immature seeds after their removal from their pods is the part which is eaten. The beans remain in edible condition for about three weeks, and the season can be extended over a period of several weeks by successive sowings. They are ready to use as soon as the seeds reach their full size, and they remain usable until the pods turn yellow and the seeds begin to shrink. The most acceptable period lies between the two extremes, and at this stage the pods are green to greenish-yellow. They may be cooked either before or after shelling, but though cooking facilitates shelling, when they are to be served hot it will usually be found most convenient to shell first. Shelling is made easier by pouring boiling water over the pods and allowing them to soak for about 5 minutes. Then drain off the water and proceed with the shelling. This can be best accomplished by taking each pod between the forefingers and thumbs of both hands, then keeping both thumbs together, snap the pod across the middle on the opposite side and simultaneously squeeze the beans into a receptacle placed to receive them. The shelled beans may then be cooked after adding about one cup of boiling water to a pint of beans, with salt to taste. Cover and cook for ten to fifteen minutes after boiling starts. When cooked, drain and serve with butter, white sauce or in any other manner. These fresh beans have a pleasing bright green colour. Avoid over cooking because it reduces their nutritive value and spoils the flavour. Green soya beans have a nutty texture and do not soften like green peas, unless they are much overcooked.

FODDER VARIETIES.

Varieties which produce large quantities of stalks, leaves and seed, but whose seed are unsuited for human consumption, are classified under this head. The isolation and testing of hundreds of strains enabled this Station to issue the varieties named Otoxi and Biltan about eight years ago. These pioneers have proved their value as fodder producers among the farmers of Mashonaland; but, like all the older varieties, they demanded immediate attention when the seed crop was ready to harvest. Crosses were made between a non-shattering variety and the older strains, and

after much testing four strains were isolated which, in some degree, possess all the desirable characteristics of both parents, with the possible exception that they require a somewhat longer period to reach maturity than Otoxi and Biltan.

These have been distributed to farmers under the names Jubiltan No. 65, Jubiltan No. 67, Jubiltan No. 77 and Jubiltan No. 109.

Although the Jubiltans produce somewhat fewer bags of seed per acre than the new Hernon strains the size of the individual seeds is smaller and the produce of an acre will re-sow about 50% more land than is possible with the yellow-seeded strains. In trials at this Station conducted over a period of five years, Jubiltan No. 77 has invariably given the heaviest yields of fodder, but reports from farmers have favoured No. 65. This is probably due to its robust, upright habit of growth. On the other hand, No. 77 has finer stems and more numerous branches than No. 65. It also requires two weeks longer to reach maturity and does not shatter its seed so quickly. Farmers who find delayed maturity an advantage should grow No. 77 in preference to other Jubiltan strains.

The chief distinguishing features of these strains are as follows:—

Jubiltan No. 65.—Erect sturdy habit of growth similar to that of Biltan. Ripens earlier than other Jubiltans but later than Biltan. Its black-coloured seed is larger than that of the other Jubiltans, but smaller than the yellow-seeded Hernons.

Jubiltan No. 67.—Erect habit, branches long and finer than No. 65. Matures earlier than No. 77. Seed-colour black and size small.

Jubiltan No. 77.—Erect habit, branches long, fine and numerous. When the seed crop is heavy the plants assume a semi-procumbent habit. Requires two to three weeks longer to reach maturity than No. 65, and for this reason, when seed production is the object, it must be sown as early in the season as possible. Trials at this Station indicate that it produces heavier crops of fodder than any other variety of soya bean. The seed is black and its size is small.

Jubiltan No. 109.—Erect habit, branches fine and long. Its fodder yield is somewhat less than that of the other strains, though it yields more seed than they. The protein content is 45.9 per cent., which is nearly as high as that of ground nut cake. The individual seeds are small and only 13 lbs. to 19 lbs. per acre are required for sowing. The seed colour varies with its age. New seed is yellow-brown, but the brown colour becomes more pronounced with advancing age or exposure to sunlight.

JUBILTAN SOYA BEANS v. HERNON STRAINS.

Average Yields, etc., in Strain Trials.

Strain No.	Growth period, days.	Yields per acre. Hay tons.	Seed, lbs.	Nutrients in seed. Protein %	Per acre.	Oil %	Colour.	Seed number in 1 lb. ± 250.	Rate of sowing lbs. per acre. Drills 36"x3"	Drills 24"x3"
65	145	3.25	1,100	44.6	491	13.9	Black	3,000	21	32
67	148	3.25	1,000	45.1	451	13.5	Black	4.100	15	22
77	160	3.75	1,100	42.4	466	14.1	Black	4,300	14	21
109	155	2.75	1,200	45.9	551	14.3	Tawny	4,650	13	19

The particulars given in this tabulation are based on data collected before the Hernon strains were established.

Variations occur in different seasons between growth periods, yields, and size of seed as well as the protein and oil content.

Jubiltan Nos. 65, 67 and 77 were included in trials with Hernon strains in the season 1941-42.

The growing season was curtailed owing to lack of rain, and this favoured the Hernons somewhat. All the varieties were allowed to reach maturity before the weight of the seed and stalks was recorded. Jubiltan No. 77 yielded more than any other strain, and if its yield is expressed as 100, then the yields of the others were as follows:—

JUBILTANS. Strain No.	Mature stalks and seed.	HERNONS. Strain No.	Mature stalks and seed.
65	72	18	68
67	90	55	80
77	100	107	72

It is seen that the yield of total fodder of some of the Hernons was as high as that of Jubiltan No. 65. Hernon No. 55 has not been included in previous trials and it is as yet too early to affirm that its productive capacity is equal to that of Jubiltan No. 65, but it appears to be nearer to the ideal yellow-seeded fodder, or dual purpose, type than any of the Hernon strains previously established.

Rate of Sowing.—Owing to their abundant top-growth as compared with that of the common yellow-seeded kinds, a somewhat lighter seeding may be given, particularly when seed production is the object in view. On fertile land the rows may be spaced 30 inches to 36 inches apart, and the seed dropped 3 inches to 4 inches apart in the rows if the crop is required for seed. For hay production the rows should be closer: from 12 to 24 inches between rows and 2 inches to 3 inches in the rows will be found to be the most economical distances. Broadcasting is less satisfactory than drilling, because the depth of covering cannot be regulated, but if necessity demand this method of sowing, 60 lbs. to 80 lbs. seed per acre should be used. Broadcasted crops

may be weeded with light spike harrows until the bean plants are 8 inches high, choosing the hotter part of the day for the work, because the stems are then less turgid and not so likely to be snapped off.

Growth above ground is rather slow at first, presumably because the small seeds of these varieties do not provide as much food material as the larger seed of the yellow kinds, combined with their need for the development of a larger root system to support the larger growth eventually made. This slow initial growth makes it more important to destroy the weeds early in the season in order that the beans may extend their root systems far and wide and successfully compete with later crops of weeds.

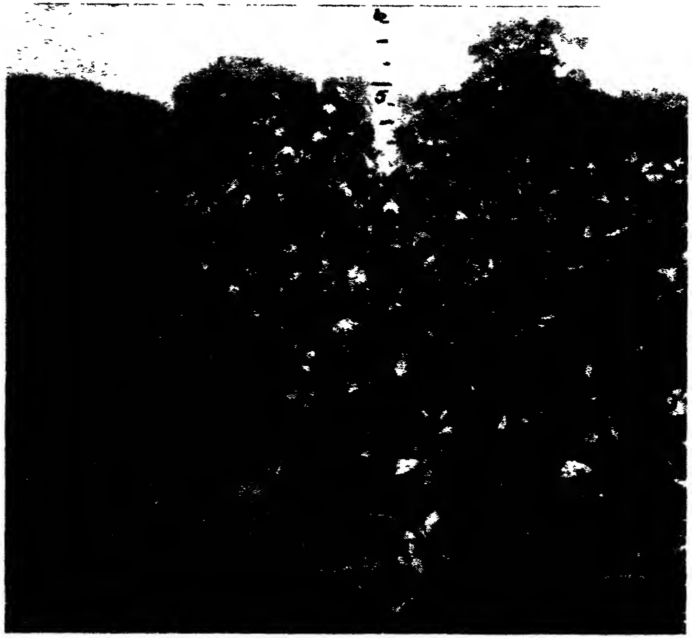
Soya bean hay is very high in quality, particularly that which is made from those Jubiltan strains having fine stems and branches, when they are cut before the plants are too old. The best quality is obtained when the plants are cut before the seed develops, but the weight of the crop will be greater if the seed is half grown before the plants are cut. During the season just past a patch of Jubiltan No. 77 was cut for hay at the stage when the pods were nearly full-sized but the seeds were still very small. When it was thoroughly dry it was beaten with a flail to separate the leaves and pods from the stalks and samples of both were analysed by the Chief Chemist's branch. The results of the analysis are shown in the following tabulation which includes an analysis of wheaten bran for comparison.

JUBILTAN SOYA BEAN No. 77.

	Stalks.	Leaves and pods.	*Wheaten bran.
Moisture%	6.92	7.66	11.9
Ash%	4.79	10.16	5.8
Crude Protein%	6.29	16.54	15.4
Fat%	.49	1.98	4.0
Fibre%	44.40	22.91	9.0
Carbohydrates%	37.11	40.75	53.9
Nutritive Ratio	1:13.1	1:4.1	1:4.0
Lime (CaO)%	1.00	2.90	
Potash (K_2O)%	1.57	2.25	
Phosphate (P_2O_5)%	.19	.43	

The soya bean hay consisted of 60% of leaves and immature pods and 40% of stalks. The analyses show that the leaves have a much higher feeding value than the stalks. The high ash content, which consists of several valuable minerals, indicates that this material would be particularly valuable for feeding to young livestock. Although the crude protein in the leaves is higher than that of wheaten bran it cannot be assumed that its nutritive value is equal to that of the bran. Only carefully conducted feeding experiments could settle that point. Nevertheless the analyses indicate that soya bean leaf meal may be found suitable for replacing a part of the wheaten bran normally used in the rations of certain classes of livestock.

*Analysis taken from a U.S. of America bulletin.



Soya Bean. Jubiltan Strain. Grown at Veterinary Research Laboratories. Season 1940-41. This crop yielded over three tons per acre of very palatable and highly nutritious hay. The colour of the seed coat of the Jubiltan strains makes them unsuited for human consumption, but they produce larger quantities of fodder than the yellow-seeded kinds.

Soya Beans Hernon 268 Grown at the Agricultural Experiment Station, Salisbury Season 1940-41. This variety has edible yellow seed which is suited for industrial purposes. Its robust habit of growth allows it to be used for hay if desired.

Soya bean hay is easier to cure than most other kinds of legume hay. Several farmers have found that their soya bean hay remained unharmed after being exposed to rain for some few days, whilst velvet bean and cowpea hay produced on adjacent land and subjected to the same treatment had been completely ruined. Although soya hay may be discoloured by the rain and its nutritional value reduced, its palatability is not impaired and cattle eat it greedily. Stockmen who have used it over a number of years say they consider it to be as good as lucerne or even better.

Harvesting: The Retention of Seed in the Pods.—In addition to their ability to produce heavier crops of fodder and seed, the strains of soya beans recently introduced are superior to the older kinds by reason of their ability to retain their seed in their pods for several days after the stalks and seeds are ripe enough to harvest. This non-dehiscent or non-shattering characteristic is nearly as important as the yield of seed itself. Climatic conditions both before and after the ripening stage affect the period that will elapse before shattering commences. Showers of rain or even cloudy skies and low temperatures after the crop has reached maturity will lengthen the period of seed retention. On the other hand, high temperatures, wind, and particularly rain, on a fully mature crop followed by drying wind, all hasten the splitting of the pods and the shattering of the seed. Both the Jubiltan and the Hernon strains retain their seed for from ten to fourteen days after it has reached maturity, but it is advisable to reap the crop and tie in bundles as soon as it is convenient to do so, after the majority of the leaves have fallen. If the bundles are then placed in stooks they can be left in the field for a further period of several days without incurring loss, excepting perhaps for a few beans on the side of the stook which is exposed to the prevailing winds.

SUMMARY.

Strains of soya beans which yield good crops of seed are now available and it would appear that the cultivation of this crop is now economically possible. The heaviest yields of seed are obtained from the Hernon strains, but those who prefer a quick maturing kind should grow Potchefstroom No. 184. The Jubiltan strains are the best for fodder purposes, but the colour of their seed and low oil content makes them less suited for milling.

Rainfall and soil conditions suited to maize are the best for soya beans also. The humus content of the soil should be moderately high for best results.

When soya beans are grown for the first time it is advisable to introduce the special kind of nitrogen-fixing bacteria which live in nodules on the roots of the plant. Bacteria laden soil can be obtained from the Agricultural Experiment Station, Salisbury, for this purpose.

The heaviest yields are obtained from crops sown early in the season, but later sowings will yield well when the rainy season is an extended one.

Both maize and wheat drills can be used for sowing the crop. The rows may be spaced from 15 inches to 30 inches apart, to suit

the types of drills and weeding machinery it is proposed to use. The seed should be sown at intervals of approximately 1½ to 4 inches in the rows, varying inversely with the space between rows. Depth of planting should be between one and two inches and on no account exceed three inches.

Harvesting may commence when the seed reaches the hard dough stage. The stalks should preferably be tied in bundles and stooked as soon as they are dry enough. The machines used for threshing maize and wheat can be adjusted for threshing soya beans also.

About five bags per acre can be expected from early sown well attended farm crops, though twice that amount has been obtained from well manured land.

The oil contained in the beans is high in quality and can be used for edible purposes as well as in the manufacture of soap, paint, etc. The proteins can be used as a substitute for animal proteins in the diet of Europeans and natives, as well as farm livestock. The valuable nutrients, protein and oil can be transported and stored more economically in the form of soya beans than is possible as maize, wheat, ground nuts or beef.

There are small quantities of seed of Hernon Nos. 18 and 107 and the Jubiltan strains available for issue to farmers in this Colony. The Co-operative Experiment Scheme enables farmers who would like to try these strains to secure sufficient seed to sow a small patch this season with the object of obtaining enough seed for more extensive sowings in future. In order that the stock may be increased as quickly as possible the seed issued should be sown on well manured land. It will be inoculated with the specific bacteria before it leaves this Station. Applications for seed, stating whether the milling type or fodder type is preferred, should be sent to the Agriculturist, Department of Agriculture, Salisbury, as soon after August 1st as possible.

The Turkey.

By G. H. Cooper, Assistant Poultry Officer.

There is good opportunity for development in profitable turkey raising in Southern Rhodesia, where there are large tracts of country admirably suited to the raising of large flocks if proper methods of management are followed. The sand veld areas are notably excellent for the raising of turkeys.

Turkeys can be kept under very simple conditions in this Colony, so that the capital outlay in the enterprise is quite small. Except during the growing season of the young poults, the management of the flock is a fairly simple matter. The vigour of the breeding stock must be carefully watched. Sanitary conditions are necessary always, especially in the young poults' quarters.

Turkeys range far and should only be kept in large numbers when free range conditions are available. They pick up a tremendous number of injurious insects in the lands and waste grains, and so turn into profit what would otherwise be wasted or be actually harmful. As much advantage as possible should be taken of this natural habit of the turkey, both from a point of view of saving waste and for the general health of the birds themselves.

Varieties of Turkeys.—The domestic turkey of to-day came originally from North America and is the lineal descendant of the wild turkey. All domestic varieties have descended from the wild stocks and comprise some six or more varieties to-day. These are the American, or sometimes termed Mammoth Bronze, White Holland, Narragansett, Bourbon Red, the Slate, and the Black or Norfolk.

The American Bronze.—This is undoubtedly the most popular breed in Southern Rhodesia and probably the world over, because of its size, early maturity and hardihood.

The Bronze males are distinguished in colour by the rich, brilliant, copperish sheen of plumage in neck, wing bows and wing coverts, breast, back, body and fluff, against a background of black and brown, each feather terminating in a narrow black band across it. The wings are barred black and white, and the main tail feathers and tail coverts have a wide white edging. The body colour is dark black brown, with a wide brilliant bronze band extending across the feathers and tipped with a narrow edging of white.

The plumage of the female is similar to that of the male, except for an edging of white on the black bars of the feathers on the neck, breast, wing bow, wing coverts and back. The white edging gets broader as it approaches the rear of the body. Shanks and toes are deep pink. Any colouring other than this denotes an admixture of alien blood.

The White Holland or Austrian.—The plumage should be pure white in colour and free from black flecking or ticking. Shanks and toes are white or pinkish white. The most prolific variety.

The Narragansett.—In colour resembles the Bronze, but the barring is a metallic black with light grey edging, and a black background with a broad white edging. The white wing band and white edging of main tail feathers and coverts give this variety a lighter appearance than the Bronze. The primaries and secondaries of both sexes are distinctly and evenly barred with black and white or grey. The female generally gives a lighter appearance than the male. The barring should be rich black and not bronze in the females.

The Bourbon Red is rarely met within Southern Rhodesia. In colour it is a rich, deep, brownish red, except the primaries and secondaries of the wings and the main tail feathers, which should be pure white.

The Slate has ashy blue or slate-coloured plumage, sometimes dotted with small black spots.

The Black or Norfolk is of a solid black colour, with a lustrous greenish-black sheen.

STANDARD WEIGHTS.

Variety.	Adult Tom 2 years or more. lbs.	Yearling Tom 1 year and less than 2 years. lbs.	Cockerel less than 1 year. lbs.	Hen 1 year or more. lbs.	Pullet less than 1 year. lbs.
American Bronze	36	33	25	20	16
Bourbon Red	30	25	20	18	14
Narragansett	30	25	20	18	14
White Holland.	28	24	20	18	14
Slate	27	22	18	18	12
Black or Norfolk	27	22	18	18	12

The adult male over one year is known as a "tom" or "cock," and the female as a "hen." From when the sex can be distinguished till one year, the male is known as a "cockerel" and the female as a "pullet." Before the sex can be distinguished, the young turkeys are known as "poults."

In distinguishing the sex of poults look for a small fleshy protuberance on the breast; this will later grow a tuft of coarse hair. The protuberance appears on males at about four months of age, but the females do not get it until they are about one year old. The hairs are much coarser in the male than the female. The "dew bill" or fleshy protuberance on the top of the head is larger and more elastic in the males than in the females. The adult males have a spur of horny structure on the inside of each shank; in the female it is very rudimentary. At about two months of age the poults have developed fleshy caruncles on the head and upper part of the neck, the appearance of which is known as "shooting the red."

Breeding Birds.—Select your breeding birds before large numbers are sold from the flock for the Christmas market. You have a larger number to select from, and the best developed birds can be saved for breeding instead of being sold. It is better to start with a breeding pen than by purchasing eggs for hatching.

The breeders should have large frames, well adapted for meat production. The back should be broad, especially over the shoulders, and the width carried well back. The body must be deep, with a well-rounded breast carried well forward. Vigour in the breeding stock is of paramount importance. A full bright eye, broad head, good bone, strong legs set well apart and not too long are desired.

Selection of the best breeding stock is very important, and failure to do so in the past is mainly responsible for the undersized stock of which we see so much in Southern Rhodesia to-day.

Management of Breeding Stock.—Adult turkeys do not require much protection from the weather in Southern Rhodesia, but it is just as well to provide them with reed or grass protection of some description, with perches, to keep off any damp, cold weather which may be experienced.

Breeding birds as a general rule are allowed free range, and this method is ideal, provided the nests can be found easily, when a shelter should be built over them to secure them from vermin. Sometimes thatched shelters are made near the house or roosting place, and, if encouraged, very often the turkey hens will adopt them. These may be made comparatively safe from vermin. However, to be really safe from these pests, it is perhaps advisable to keep the breeding birds in a wired enclosure. Sufficient room to afford plenty of exercise is necessary, a flock of 15 birds requiring half an acre. An orchard forms an ideal spot. Four-foot pig netting is enough to keep the birds in, for as a rule they cannot rest on the top wire and so do not fly over. However, if they persist in getting over, the flight feathers of one wing may be cut, or, as in some countries, a small piece of light board may be fastened across the back by notching the board and tying it with a strip of cloth to each wing, so that when the wings are raised they strike against the board and prevent flying.

Where free range is practised and there is difficulty in locating nests, confine the birds early one morning as they come from the roost and do not let them out until the afternoon, when, as a rule, they will make straight for their nests to lay the eggs which they have been holding up.

Feeding the Breeding Stock.—This is a simple matter. It is important, however, to keep the breeders in good condition, and they should be well fed, but not over-fed. Where turkeys have plenty of free range they should obtain an ample supply of insects, green feed and seeds, but it is also advisable to give them a daily feed of grain, such as a ration of equal parts of maize, wheat and oats, if possible, fed preferably just before they go to roost. See that the grain is wholesome. During cold weather an extra feed of grain may be given daily. If maize is the only available grain, too much should not be fed, but a little bran mash should supplement it. If green food is scarce on the range, it should be supplied. Cabbages and roots, such as carrots, mangels

or pig melons (majorda), are excellent. Thick separated milk is very desirable to use with the grains, and if it is not available some kind of animal food should be fed, preferably in a laying mash during the breeding season. Feeding should be regular, but not overdone, especially the maize part. Change the place of feeding frequently. Liberal supplies of grit, oyster shell and charcoal must be given.

Mating.—Best results from the standpoint of mating are obtained when from 6-10 females are mated to a healthy, vigorous tom or male bird. If more hens are kept, more males should be used, but great care should be taken not to allow two toms to run together. When from 20-25 hens are kept, the toms should be alternated every other day, or 3 or 4 may be used.

The selection of the tom from the standpoint of type and constitutional vigour is very important; the females should also be kept up to standard as far as possible. The aim in mating up a breeding pen should be to choose birds as near standard weight as possible.

Best results are obtained when a vigorous, well-grown tom cockerel is mated with yearling hens (between one and two years). Sometimes early hatched pullets are used; if so, they must be well matured, otherwise there is great danger of lowering the vitality of the stock. Yearling and older toms may be used if desired, but their excessive weight may cause injury, while they are not so active, and fertility is sometimes poor. When they are used, their spurs and nails should be trimmed. They should be mated with early hatched, well matured pullets to obtain the best fertility.

Egg production decreases materially after three years, so it is advisable to replace any three-year-old breeders with younger birds. Turkeys should not be in-bred, as it results in lowering the vitality and growth of the stock. Obtain new blood by purchasing male stock from some outside source. Great care should be exercised in choosing breeding males from reliable breeders, whose stock is first of all healthy and vigorous, approaches standard weight and possesses other standard qualities to a high degree.

Egg Production.—The natural time for turkeys to lay is during the late winter and spring months. Any laying mash, if fed to the breeding birds a month or so previous to the time when eggs are desired for hatching, should bring them into lay, if any trouble is experienced in this respect. All hens do not begin to lay at once, and six weeks may elapse between the commencement in individuals. Usually a hen starts to lay about 10 days after the first mating, and she has by that time found a nesting place. Turkeys lay in clutches—on the average, about 20 eggs are laid in the first clutch; the hen then goes broody. When the broodiness is over, another clutch is laid, and often a third, each clutch containing fewer eggs. Hens may be made to lay more eggs if the eggs are taken away as they are laid, always leaving one in the nest, or if a laying mash is fed during the breeding season. When the hens are not required to hatch their eggs, they may be broken of their broodiness by putting them in a wire coop until they are over the broody fever, when they will commence

to lay again. This is desirable where incubators are used for hatching, especially in hatching the first clutch, for it saves time, and the second clutch is laid sooner, thereby enabling one to hatch more early chicks, which grow out much better.

Hatching.—The success in turkey raising depends upon the number of birds brought to maturity in proportion to the number of eggs set. High fertility is necessary. The vigour of the breeding stock, the manner in which it has been managed and the care given the eggs will determine to a large degree the quality of the hatching eggs. An average of 10-15 mature birds raised for each hen is considered very good.

The eggs should be collected regularly every day and kept in a room at a temperature of 50-60 degrees Fahrenheit. For the best results they should not be kept longer than 10 days before setting. The period of incubation of turkey eggs is 28 days, and the method much the same as with chickens. They may be hatched in incubators, under turkeys or chicken hens, but the latter is not advised. Likewise, they may be brooded artificially or with turkey hens. The first method is the better, especially where large numbers are reared, for the poults are not so likely to contract disease and vermin that way.

When hatched in incubators, the temperature should be slightly lower than that required for hens' eggs. Start the machine off at 101 degrees Fahrenheit, when, by hatching time, it may go up to 103 degrees Fahrenheit. The eggs should be turned two or three times daily and tested on the 10th and 20th days, removing all infertile eggs and those having dead germs. On the 26th day the incubator door should be darkened and kept closed until hatching is completed. Day-old poults may be despatched successfully if slightly larger boxes than commonly required by baby chicks are used.

The turkey hen when broody should be allowed to sit on the nest for two or three days before being entrusted with the eggs. When she has remained constantly on the nest for two or three days she should be given her eggs, preferably slipped under her at dusk. Turkey hens when sitting should be dusted with sodium fluoride under the feathers next the skin. A pinch on the head, under each wing, between the thighs, below the vent and along the breast is sufficient. This is important and should be done at least twice, once when the hen is set and once before hatching, to ensure that the poults may get a good start free from lice, which are very dangerous to newly-hatched poults. The nests should be covered, so that the hens will not be disturbed. At the same time turkey hens often sit too tightly, and should be taken off daily and allowed to exercise and dust themselves. They should have access to clean, cool water at all times, and should be given wholesome grains as feed. Maize, sunflower, munga, wheat and oats are excellent. When hatching is completed, the hen should be dusted, as stated previously, and put in a warm, roomy, comfortable coop, with plenty of dry cut grass on the floor and slats in front, in and out of which the poults can run at will, but the turkey hen herself must be confined, otherwise she will drag the poults through the long and often damp grass and heavy losses will result.

Rearing.—This is the most important part of turkey raising, for the greatest losses invariably occur during the first five weeks after hatching. Heavy mortality among the poults indicates that the breeding stock used was low in vitality or poorly managed.

Both the poults and breeding turkeys must be kept on ground free from any infection and away from chickens. This is important. The poults should be raised entirely separate from the chickens and the breeders away from the rest of the poultry on the farm. Care must be taken to guard against draughty, badly-ventilated coops and dampness, for young poults cannot stand much of this. Keep them comfortable and well fed, the digestive system healthy and disease will not find a port of entry.

Rearing the poults by turkey hens is not a difficult matter, although there are several details which should always receive careful attention. As stated previously, when the hatch is completed the hen and her brood should be transferred to a roomy coop with slatted front, which will afford protection from rain, wind and predatory animals. A coop of the apex type, 4 feet long by 6 feet wide by 3 feet high is required. Each hen should have a separate coop, and these should be placed some distance apart on well-drained clean soil, where the grass is fairly short. The first day the poults should be confined with the hen, after which they may be allowed out. A small wire netting enclosure may be provided, but it is not absolutely necessary, as they will not wander far from the hen. Care must be exercised not to allow them out during rain or if the grass is wet. The coop should be moved to fresh ground every day and should be cleaned and disinfected frequently. When the poults are a fortnight old they may be allowed to roam with the hen, and should do so; see that they all return at dusk and are safely housed at night from predatory animals. During wet weather they should be confined, as any dampness is usually very fatal to young poults. In continuous inclement weather they may be housed in a barn with short dry grass, if this is possible. The poults may be kept with the mother hen for a long time, but better results are obtained by moving them to a separate rearing field when they are about 12 weeks old.

When artificial incubation is employed, artificial brooding usually follows. The poults should remain in the drying box of the incubator until they are 24 hours old; they should then be taken out and placed in a brooder similar to that used for ordinary chicks, with a wire run attached, and treated in the same way. The brooder and coop should be moved to fresh ground daily. (See Bulletin No. 1182. "Artificial Incubation, Brooding and Rearing of Chickens."

The artificial method of brooding makes it easier to maintain proper sanitation; it puts the poults more directly under the control of the person in charge and gives the breeding birds more time for laying, thus more poults can be reared from them during the season. Brooding by turkey hens has the advantage of allowing the poults to be raised in small flocks and of readily providing free range conditions. There are disadvantages, however, especially as the young turkeys may contract disease and parasitic infection from the hens or they may wander too far, and losses occur through storms or by predatory animals.

Turkeys, when reared in large numbers, may be brooded successfully by means of the hover stove and portable colony house.

It is a good plan to adopt some system of marking the poults when raised in any numbers, either by toe-punching or wing-banding, in order to keep accurate records of birds from special matings or for identification purposes if a near neighbour also raises turkeys.

Feeding.—The feeding of the poults is a very important matter, both from the standpoint of the kinds of feed given and also the manner in which they are fed. Unwholesome feeds and improper methods of feeding, especially if the poults are confined, have resulted in many failures in turkey raising. Many are killed by over-feeding and by being supplied with sour, stale food. Poults, being less active than chicks, sometimes have difficulty in learning to feed when artificially brooded. Dipping their beaks in milk and giving sharp, shiny grit helps to induce them to eat. Poults under free range conditions are less liable to suffer from improper methods of feeding.

The same rations and methods of feeding used for baby chicks are often used for rearing turkey poults. The turkey hen, whilst confined in the coop, should be given a grain mixture of maize, sunflower seeds and wheat, or any of the suitable farm grains. Green food, grit and clean, cool water are also necessary. In feeding the hen and poults, it is advisable to feed the former inside the coop and the latter outside, in order to prevent her from eating the feed intended for the poults.

No food should be given the poults for 36 hours after hatching; access to clean drinking water and a little coarse sand and finely chopped green feed is all that is necessary. Their first feed may consist of stale bread soaked in separated milk and squeezed dry, fed five times a day in small quantities so as always to keep them hungry. If they are picking up insects and other food around the coop, three feeds a day should be sufficient. See that the food is properly dry, as wet food soon becomes sour and is fatal to them. It is best fed in troughs. Milk, especially butter milk, is excellent for them. Keep it before them all morning and give them water during the afternoon. The only grain required is finely-crushed maize and munga, preferably fed in a thin layer of finely-chopped grass to promote exercise. If a mash is desired, the following may be fed in a small hopper: 30 lbs. mealie meal, 15 lbs. bran, 10 lbs. pollard, 5 lbs. lucerne or sunflower leaf meal, 3 lbs. meat meal or other animal food, 3 lbs. bone meal, or equal parts of bran and mealie meal with a little bone meal, in conjunction with sour separated milk and green food, will give excellent growth. The green food should be placed in a receptacle. Chopped onion or eschalot tops, lettuce, lucerne, etc., are all excellent. Grated or finely-chopped carrots are greatly relished, and are an excellent feed for them. Small grit or coarse sand and charcoal should always be before them.

After the poults are from six to eight weeks of age they may get most of their living from good range, but a little additional grain feed, as crushed mealies and munga and even mash, will give added growth and earlier maturity. Milk in some form is

very desirable in their feed. Feed the poults on range regularly every night and they will return home on their own, but is is usually advisable to have a piccanin in charge of them.

During the spring and summer, turkeys can find much feed on the average farm. Grasshoppers and other insects, weed and grass seeds, green vegetation, berries and gran picked up in the fields make up their ration. When this natural food is plentiful very little need be added, except a small feed of maize every evening to bring them home, or, if food is scarce, a large feed of grain in the evening.

When the birds are being prepared for market they should have, in addition to their evening feed of maize, one of preferably wheat, or, if unobtainable, munga, in the morning; but this should only be a small feed so that they will still be hungry when they go on range. This may be increased gradually and a further feed given at midday, until they will finish up three good feeds a day about a week before marketing. The ration at this time may be varied with the addition of sunflower seeds, and ground nuts are also excellent. Small chunks of carrot are excellent for them at this stage too. Thick separated milk if available cannot be over-estimated as a feed. Charcoal should be supplied. Turkeys should not be confined for fattening, as they mope and lose weight, but the amount of range may be somewhat restricted. Feed last season's maize in preference to new grain, but it must be wholesome and not musty.

Remember that more feed per pound of grain is required as the bird gets older.

Marketing Turkeys.—In Rhodesia this can only be satisfactorily carried out by obtaining contracts for so many per week or month throughout the year with hotels, boarding houses, etc. To dispose of them haphazardly means a most uncertain market, both as regards quantity and price; further, the turkey raiser can have no idea as to the number he will require to produce. There is always a good market at Christmas, but that is only once a year.

Housing.—A turkey house should never be erected on low-lying damp ground, nor upon heavy clay, for on such land turkeys will never do well. The house should be large, with an open wire netting front. It should at least be 8 feet high in front and 6 feet at the back, and from 8 feet to 10 feet deep, and as wide as necessary for the number. The roosts should be 2in.-3in. wide and 4 feet from the ground, running from side to side. Allow 18in. of perch space per bird and 2 feet between perches. The roof must be watertight, and the house perfectly dry and airy, and on the floor a good layer of dry grass placed. Any material is suitable, provided the above points are attended to, e.g. well combed, thick grass, good pole and dagga, brick, etc., are all suitable. The house should have a Northern aspect.

Disease and Parasites.—Avoidance of parasites and prevention of disease should be the first aim of every turkey raiser. Good management will keep the flock free from parasites, and the selection of breeding stock having abundance of constitutional vigour will help materially in preventing disease. Turkeys should always be given the best possible surroundings. Provide free range on clean sanitary soil, wholesome feeds, including plenty of green food, protection from dampness, and strictly sanitary quarters.

Lice may be troublesome, especially among the young poults, often causing heavy losses. Head lice cause most of the trouble. Poults should be examined occasionally, and if the lice are found, a little lard should be applied to the head and neck. Sodium fluoride may be used very sparingly on the poults if body lice are found, but should not be applied until the poults are at least a week old, and then only two small pinches should be used—one on the neck, head and throat, and the other on the back and below the vent.

The most serious diseases to which turkeys are subject are coccidiosis, roup and chicken-pox. Pamphlets dealing with these can be obtained from the Poultry Officer, Department of Agriculture, Salisbury.

SUMMARY.

To be successful in turkey raising, one must give the most careful consideration to certain fundamental factors. The turkeys, especially the growing stock, must be kept under the best possible conditions. An abundance of free range on clean soil is greatly to be desired. Every effort should be made to keep the soil sweet and clean. This is particularly true of the soil on which the birds are fed and where they roost.

Another fundamental essential is to keep healthy and vigorous breeding stock in the best possible breeding condition. The breeders should get plenty of exercise and should not be fed too heavily on fattening rations. By breeding from the most vigorous birds every year, a flock of healthy stock may be developed and maintained. Great care should be exercised in the selection of male breeders each year.

Both old and young turkeys should be protected from dampness. In sections of the Colony where dampness is prevalent, or where rainstorms are frequent, the birds should be provided with suitable protection.

It is very important not to feed the poults too heavily, especially for the first few weeks. Keep them just a little hungry.

Watch the poults carefully for the appearance of lice, and take every precaution to keep this pest in check.

So far as possible, remove the cause of any disease that may appear. Clean soil, sanitary quarters and hygienic methods of feeding will do much to reduce mortality.

Success in turkey raising is largely a question of proper management.

Hand-Rearing of Calves.

By C. A. Murray and A. E. Romyn, Division of Animal Husbandry.

It is very much more profitable to hand-rear calves than to allow them to suckle their dams. Figures published* by the Division of Dairying in the Union show that the average production of 11 cows while suckling their calves was 86 lbs. butterfat, and for the same cows during the next lactation, when their calves were hand-reared, 239 lbs. butterfat. The increased production per cow in favour of hand-rearing was therefore 153 lbs. of butterfat, worth £11 9s. 6d. at 1s. 6d. per lb.

In addition to being a very much more profitable practice, hand-reared calves (if properly cared for) are generally more healthy, suffer less from scours and turn out much more docile cows than ones raised on their dams.

Calves to Rear.—Do not rear bull calves (except for stud purposes) nor inferior heifer calves. Also, discard undersized, weak calves at birth unless very valuable from a breeding point of view. Rear only heifer calves from the better cows, sired by a good bull.

To maintain a herd without buying cows at least three heifers for every ten cows in the herd should be reared annually. It may be profitable to rear a considerably larger number if the herd is to be increased, or severe culling is practised, or if there is a good market for surplus stock.

Preparation of the Cow for Calving. — Calf-rearing begins before the calf is born, i.e., with the care of the pregnant dam.

If the cow is still milking, it should be dried off six to eight weeks before calving. During her dry period, if she is down in condition, feed her well so that she may recuperate from the previous lactation, build up a supply of body reserves and nourish the unborn calf. Depending on her condition, give her some good quality roughage, such as legume hay and silage, and if necessary some concentrates in addition. In summer, good grazing will usually be sufficient, always bearing in mind that it pays to calve down dairy cows in good condition.

At calving time give the cow careful attention, and keep her under observation so as to be able to assist at the proper time if there is any difficulty at calving. See that her bowls are loose. A supply of green feed or silage is very valuable for this purpose during the dry season. Do not calve in dirty kraals or stables. In summer a small grassy paddock with ample shade and shelter is an ideal place for calving. Although the cow will usually require no assistance, some one should always be available in case of necessity.

*Hardy, E. G.—Bulletin 34, 1927. Department of Agriculture, Union of South Africa.

Management of the Young Calf.

Care of the Calf after Birth.—Leave the calf with the cow until it has been licked dry. Generally the best results will be obtained by taking it from its dam ten to twelve hours after birth. During the first four days of its life always feed the calf its dam's milk, i.e., the colostrum. This is very important, as it acts as a laxative, cleans out the digestive tract and assists in preventing digestive troubles.

Teaching the Calf to Drink.—Before attempting to teach a calf to drink, allow it to become hungry by not feeding it for ten to twelve hours after taking it from its dam. Then back it into a corner, stand astride its neck and let it suck the fingers (see Fig. 1). While sucking, gradually lead its head into the bucket, and as soon as it starts taking some milk withdraw the fingers slowly. After two or three lessons in this way the calf will drink readily from a bucket.

De-horning.—Horns do not increase milk production. They are fancy points interfering with the commercial value of a herd. De-horned cows are more docile, easier to handle and return better profits.

De-horning is a very simple operation, and should be done when the calf is two to five days old. The horn " buttons " can be felt easily at this stage. With a pair of scissors clip the hair short over each " button," and with a stick of caustic potash slightly moistened rub hard on each " button " in turn, until red and just about to bleed. That is all that is required. The only precaution necessary is to keep the calf out of rain for a few days to prevent the caustic potash from running into its eyes. (Sticks of caustic potash can be obtained at a very low cost from all chemists. Care should be taken not to touch it with the hands.)

Regularity and Cleanliness. – The calf, like its dam, is a creature of habit and soon becomes accustomed to a given routine. Any interruption in this routine will upset the calf. Therefore, feed the salf at the same time each day, give it milk at the same temperature, and make all changes in ration as regards quantity and quality gradually.

Keep the pens, buckets and other equipment scrupulously clean, and protect the small calf against rain and draughts. These are all fertile sources of calf diseases and should be guarded against.

Management and Housing.—For the first two or three weeks it is best to keep the calf in a small, dry, well-bedded pen. From then on it may be allowed out both day and night, depending on the weather. Do not allow calves under six months of age out in rain or very cold weather. A small paddock with good grazing, water and shelter close to the pens is very desirable.

Although individual pens about 3 ft. 6 in. by 5 ft. are best, they are not always possible. A lean-to shelter, protected from wind and draughts, kept dry and well bedded, will serve the purpose. A pen 16 ft. by 10 ft. will be large enough for seven to nine calves. To facilitate feeding and prevent the calves from sucking each other's ears and udders, a stanchion should be built along one side (see Fig. 5). In front of the stanchion a partitioned feed trough

should be provided for the buckets to stand in and in which the grain may be fed. This arrangement will prevent the buckets from falling over and will ensure each calf getting its share of concentrates. Against the back of the pen a hay-rack should be fixed.

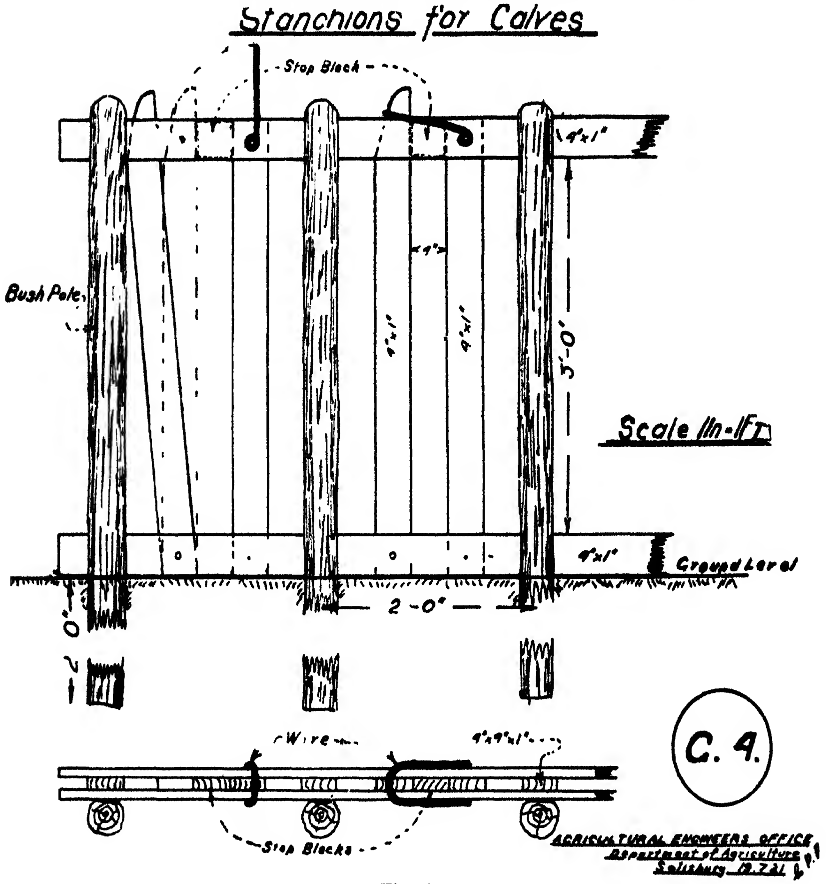


Fig. 5.

Feeding the Calf.—Unless the calf is unduly small or weak, two feeds a day are quite sufficient. Always give the milk in clean buckets at blood-heat temperature. Do **not** feed cold milk. During the first four days give the calf its dam's milk. This is essential. Rather under feed than over feed. Over feeding causes scours, and this will set the calf back for weeks or months.

Offer Grain and Hay Early.—From about the eighth day the calf will start nibbling at hay. Always give it access to **good quality** hay from a rack. Do not give mouldy or poor quality hay. From the second week encourage it to eat concentrates. This may be done by rubbing a little of the concentrate mixture on its nose or by putting a little in the bucket after the calf has finished its milk. Always feed the concentrates **dry.** It is not necessary to feed concentrates boiled, soaked or in the form of a slop.

Raising the Calf on Skim-milk.—From the beginning of the third week skim-milk may be substituted for whole milk, so that at the beginning of the seventh week the calf will receive skim-

milk only. Always make the change from whole milk to skim-milk gradually. The rate of change should be determined to a large extent by the strength and vigour of the calves.

Feeding Schedule.—The following feeding schedule has been found very satisfactory (see figure 2) at the Government Experiment Station, Matopos:—

1st week: ¾ gallon (6 pts.) whole milk per calf per day.

2nd week: 1 gallon (8 pts.) whole milk per calf per day.

3rd week: 1 gallon (8 pts.) whole milk p.c.p.d., plus ¼ gallon skim-milk.

4th week: ¾ gallon (6 pts.) whole milk p.c.p.d., plus ½ gallon skim-milk.

5th week: ½ gallon (4 pts.) whole milk p.c.p.d., plus ¾ gallon skim-milk.

6th week: ¼ gallon (2 pts.) whole milk p.c.p.d., plus 1 gallon skim-milk.

7th week: 1½ gallons skim-milk.

8th to 20th weeks: 1½ gallons skim-milk.

21st week: 1 gallon skim-milk.

22nd week: ¾ gallon skim-milk.

23rd week: ½ gallon skim-milk.

24th week: ¼ gallon skim-milk.

Calves fed according to the above schedule will do well if supplied in addition with good quality veld hay as roughage and with up to 4 lbs. daily of practically any one or a combination of several of our farm-grown grains. The following are a few practical concentrate rations:—

1. Crushed maize.
2. Equal parts of maize meal and kaffir corn meal or nyouti meal.
3. Equal parts of maize meal and ground oats.
4. Four parts of maize meal and one part of ground beans.

(To each of these mixtures should be added 2 per cent. salt.)

Feed in general about as much grain as the calves will clean up, but not to exceed 4 to 4½ lbs. per calf per day.

Where only a limited amount of skim-milk is available, it may be cut down or cut out altogether after the 12th week. However, when this is done, legume hay should be fed and some protein-rich feed included in the concentrate ration. The following are satisfactory mixtures under these circumstances.

1. Three parts maize meal and one part monkeynut cake.
2. Three parts maize meal and two parts bean meal.

(To these mixtures 4 per cent. bone meal and 1 to 2 per cent. salt should be added.)

Kaffir corn, nyouti or oats may be substituted for part of the maize.

Contrary to the usual practice the majority of feeding trials show that whole or coarsely ground grains are preferred and lead to cheaper and improved grains. There is, therefore, no necessity to grind calves meals finely if they are dry fed.

Raising the Calf on a Limited Amount of Whole Milk.—On farms where cream is sold and skim-milk is available the rearing of calves presents little difficulty. The case is different, however, where farmers are selling whole milk in towns or to cheese factories. Under these conditions many dairymen consider it uneconomical to rear the calves because of the relatively high value of the milk.

Extensive investigations into the raising of calves without milk have been carried out in overseas countries. Although certain calf meals and milk substitutes have given fairly satisfactory results, it is now generally admitted that there is no satisfactory substitute for whole milk in the ration of young calves, and that some whole milk must be fed for a while to give the calf a good start if satisfactory growth is to be made.

When rearing calves on a limited amount of whole milk the principle method usually followed is to give the calf a good start on whole milk for a limited period of up to six to ten weeks, and then to rely on a suitable ration of concentrates and hay.

A feeding schedule which has given satisfactory results at the Rhodes Matopo Estate under this system is shown below:—

Period in Days.	Period in Weeks.	Whole Milk per Calf per day.
1st day with dam		
2nd day dam's milk	1st	4 pints.
3rd to 7th day dam's milk		6 ,,
8th to 14th day whole milk	2nd	8 ,,
15th—21st ,, ,, ,,	3rd	10 ,,
22nd—28th ,, ,, ,,	4th	10 ,,
29th—35th ,, ,, ,,	5th	12 ,,
36th—42nd ,, ,, ,,	6th	10 ,,
43rd—49th ,, ,, ,,	7th	8 ,,
50th—56th ,, ,, ,,	8th	6 ,,
57th—63rd ,, ,, ,,	9th	4 ,,
64th—70th ,, ,, ,,	10th	2 ,,
71st—180th ,, ,, ,,	11th to 26th	0 ,,

Each calf, therefore, received 655 lbs. (65 gallons) of whole milk, of 635 lbs. of saleable milk. The calves were fed milk twice daily.

The following concentrate mixture was fed dry. When receiving no milk, the calves may be expected to consume from about 1 lb. per head per day of the mixture in the second month to about 5 lbs. per day at six months of age.

150 lbs. maize meal.
50 lbs. bran.
50 lbs. monkeynut cake.
25 lbs. bloodmeal.
10 lbs. bonemeal.
5 lbs. salt.

Teaching the calf to drink

Heifers should not be neglected after weaning—10 months old heifers eating dolichos bean hay. A small amount of silage was given twice daily.

A practical set of Calf Stanchions.

The bran may be replaced by a good legume hay meal. **The calves should be encouraged to consume as much concentrates as possible as a success of this method of calf rearing depends on inducing the calves to eat grain freely.** In fact, the allowance of milk should not be reduced permanently until this happens.

The Use of Gruels in Calf Feeding.—Where milk is only available in limited quantities, some dairymen prefer to feed most of the meal as a gruel rather than as a dry mixture. It is claimed that in this way the calves will consume more concentrates than if the whole amount is fed dry.

The feeding of gruels requires very careful attention to be successful, and, on the whole, their use has decreased in recent years.

A simple gruel quoted by Shrender and Groenewald of the Union Department of Agriculture and Forestry, Bulletin No. 224, 1940, is one of equal parts by weight of linseed meal, bloodmeal and pollard. One part of this mixture is mixed with eight parts of water and brought to the boil. The gruel is then allowed to cool and is fed at body heat.

The feeding schedule suggested is as follows:—

FEEDING GRUEL TO CALVES

Age of Calf	Milk lb.	Gruel lb.	Grain lb.	Hay lb.
1 to 2 days	with dam	--	—	—
2 to 14 days	10	---	—	—
2 to 3 weeks	9	1	---	—
3 to 4 weeks	9	3	1/8	free access
4 to 6 weeks	6	6	1/4	,,
6 to 8 weeks	-	12	1/2	,,
8 to 12 weeks		14	1	,,
12 to 16 weeks	--	14	2	,,
16 to 20 weeks	—	--	4	,,

The actual quantity consumed will depend on the size of the calf, but in general the gruels are fed in much the same quantities as separated milk. Ground nut meal or soya bean meal would probably take the place of linseed meal in the above mixture. All the ingredients should be finely ground so as to remain in suspension. Another mixture which has been used is one of equal parts by weight of maize meal, pollard, groundnut meal and bloodmeal. If, as sometimes happens, the calves do not take readily to this amount of bloodmeal it can be reduced for a few days until they will take the normal quantity. There are also proprietary calf meals that serve the same purpose. When these are used the manufacturers directions should be followed.

Feeding the Young Heifer.—Do not neglect the calf after the sixth month. If good summer grazing is available no extra feed will be required at this stage, except on very poor veld. In winter, depending on the feeds available, one of the following rations will prove satisfactory:—

1. Legume hay and silage or other succulents such as sweet potatoes, majordas, etc.—as much as they will take. This will be about 5 to 10 lbs. legume hay and 10 to 12 lbs. succulence daily. For animals under 10 months give 2 lbs. crushed maize daily in addition. After 10 months the two roughages alone will be sufficient. This ration has been used very successfully and found very economical at the Government Experiment Station, Matopo Estate.

2. When no legume hay is available, but only succulence as above and veld hay, or maize stover, a satisfactory ration is one of hay and succulence ad lib and 1 lb. of monkeynut cake daily in addition. Two pounds of ground beans or cobbau seed can replace 1 lb. monkeynut cake.

3. When legume hay only is available and no succulence, allow the hay ad lib and give 2 lbs. crushed maize daily in addition.

4. With veld hay or maize stover available and no succulence, allow hay ad lib and give 3 lbs. daily of a mixture of equal parts of maize meal and monkeynut cake in addition.

Of the above rations, No. 1 is the most practical and economical.

Don't Forget.—If a calf is worth rearing at all, it is worth rearing well.

ANSWERS TO CORRESPONDENTS.

Brighton Erleigh.—You could hardly have done better. Your letter indicates that you realise all that "C.A.I.C." stands for. We need not wish you good luck because you already have good sense.

Anonym.—As you have failed to include your name and address we cannot publish your letter and have therefore forwarded it to the salvage depot, where refuse is collected and turned to good use—just as on a well-run farm.

Cleanliness Aids Insect Control.

Turkish Tobacco.

CULTURE AND MARKETING IN SOUTHERN RHODESIA

By J. C. Collins, B.Sc., Assistant Tobacco Officer.

Following the publicity recently accorded to the production of Turkish type tobacco in Southern Rhodesia, considerable interest is being displayed in the cultivation of this crop. The demand for Departmental Bulletin No. 1167 *having exhausted available supplies, it has been found necessary to re-publish it. The opportunity has been taken to include several modifications or improvements introduced since the bulletin was originally published. The new matter has been inserted in the text in italics.—D. D. Brown, Chief Tobacco Officer.*

Requests have been received from growers for more up-to-date information regarding the production and disposal of Turkish tobacco, for since the publication in December, 1928, of Departmental Buletin No. 715, "Turkish Tobacco Culture in Southern Rhodesia," by D. D. Brown, Chief Tobacco Officer, certain important changes have been introduced, changes which are associated mainly with the processes of curing and the methods of marketing. It should be realised, therefore, that this article essentially constitutes a revision of that Bulletin and in consequence appreciation is accorded to Brown for use of the foundation material.

The changes referred to are largely the result of a distinct variation in the type of tobacco now demanded by the manufacturers, the nature of whose demands is in turn controlled to a large extent by the tastes of the smoking public.

Climate.—Seeing that Turkish tobacco is sun-cured, it necessarily follows that climate plays an all-important role. The incidence of rain during curing operations may cause considerable damage to the leaf on the curing racks, for once the leaf becomes wet, it is liable to discolour badly. Similar damage will result from excessively humid atmospheric conditions such as heavy mists. Rain, however, is essential during transplanting operations and the period of early growth, but once the plants approach maturity, there should be no heavy downpours but just light showers, sufficient to help on the plants but insufficient to wash the gum off the ripening leaf thus rendering the cured produce thin, papery and lacking in body, flavour and aroma.

The production of Turkish tobacco should, therefore, be limited to localities where the rainfall normally ceases one month after transplanting and thereafter there are only scattered showers, with practically no rain or mist during the curing season. The plant is also very susceptible to frost and should not be grown in areas where early frosts are of common occurrence.

In Southern Rhodesia, where the rainy season normally commences between the end of October and mid November and continues till the latter end of March, the period of heaviest rainfall being December to February, transplanting operations usually commence about the beginning of January and terminate in March.

As a result of the crop being planted later in the season than is Virginia tobacco, it follows that planting conditions are far more satisfactory, as not only can one count on receiving a shower of rain, but the soil, too, has by this time built up a fairly high moisture content, thus enabling the young transplants to establish themselves more readily.

The question of when to prepare and sow seed-beds is dealt with at a later stage in this article.

Soils.—In the old days the demand was for leaf dark mahogany in colour so that the crop was grown to advantage on red clay loams derived from diorite, dolerite, schist and banded ironstone formation. To-day, however, the exact reverse is the case. There is no longer a demand for dark leaf; what the market now wants is bright leaf varying in colour from lemon to light mahogany. In consequence production should be confined to sandy loams of granitic or sandstone origin and to the lighter types of "contact" soils.

"Contact" soils are essentially intermediate in texture and structure between light and heavy-bodied soils. They occur on the line of contact at which the one type merges into the other and, consequently, the regions nearer to sand veld are lighter in body than those contiguous to clay soil. It is the lightest of this class that is used for Turkish.

Both the sandy loams of granite and sandstone origin, as well as the light "contacts" show considerable variation in colour. They may be white, pink, light red or various shades of grey.

Confusion should not be made between light soils and infertile soils. Because a soil happens to be light in texture it does not necessarily follow that it is infertile. Nor, because a heavy clay soil has been found to be lacking in fertility should the grower consider planting it to Turkish tobacco. For the production of good quality Turkish it is absolutely necessary to select a good fertile light soil.

Soil fertility depends upon a number of factors, and of these the following five are considered to be the most essential. All five are of equal importance.

(1) Abundance of available plant food (richness), i.e., on virgin veld a thick vegetation cover not only of bushes and trees, but also of grasses and weeds. On non-virgin veld the adoption of the principles of good field husbandry.

(2) A good mechanical state, i.e., a texture which will allow of successful tillage.

(3) Absence of injurious substances.

(4) A wholesome or permeable subsoil.

(5) A suitable situation.

A soil possessed of all these conditions will be well-drained, mellow and wholesome, whereas, if deprived of any one of them, its agricultural value will be destroyed.

Soil texture greatly influences the yield and quality of the tobacco produced; the standard of both being reduced where the soil particles are large and coarse. Improvement can, of course, be effected by proper applications of fertiliser, but whenever possible it is generally more economical and more satisfactory to use a finer textured soil.

Depth of soil is another important factor. In Southern Rhodesia the depth of top-soil varies from about three inches to eight inches on granite sandveld and to a greater depth in soils of sandstone origin. It is generally recognised that other things being equal a deep soil is likely to be more productive than a shallow soil, even if the former is deficient in its percentages of fertilising ingredients.

When selecting soil for the crop, the nature of the sub-soil must also be taken into acount, as it has a marked bearing on the quality of the top-soil. If the sub-soil is a stiff impervious clay the land may become water-logged during seasons of heavy rainfall and as a result of this condition the sub-soil is sure to contain sour materials due to imperfect oxidations, which may even be actually poisonous to the tobacco. On the other hand, too porous a sub-soil such as an open gravel, wil not retain sufficient moisture, and will result in excessive leaching of plant food material, so that the crop is liable to suffer from drought and starvation.

Brown has described the most suitable sub-soil underlying granite sandy soils as being reddish in colour and containing clay, sand and gravel in suitable proportions. He also warns growers against a bluish coloured clay sub-soil whcih is to be found in certain parts of the Colony. ([1]).

Closely coupled with soil conditions is the question of the locality itself. As much as possible avoid large exposed, wind-swept areas. The land selected should be sheltered from the prevailing winds and should have a gentle slope with a good natural drainage.

Selection of Seed-bed Site.—In selecting the site for the seed-beds the following points should be taken into consideration:—

(1) Proximity to a permanent water supply.

(2) Suitability of soil.

(3) Proximity to the fields.

(4) Proximity to the homestead.

(5) Exposure.

(6) The nature of the terrain.

It is essential that the site be as near to a permanent water supply as is possible. Owing to Turkish seed-beds being sown in December, that is during the early stages of the rainy season, they do not require much artificial watering as do Virginia beds, nevertheless, as considerable recourse has to be made to the watering can, the water supply should not only be permanent but near to hand.

The site selected should possess a good natural drainage, and for this reason vleis should be avoided as they are apt to become water-logged during heavy rains.

The most suitable soils for tobacco seed-beds are sandy loams and alluvial soils which have a good supply of humus and are naturally well drained, friable and fertile. ([2]).

The proximity of the seed-bed site to the fields in which the tobacco is to be ultimately planted is another important factor, though not a vital one. Close proximity naturally eases the situation as far as time and labour are concerned, and it also enables the young seedlings to reach the field before they have had time to wilt.

Seed-beds are the foundation of the crop; they can never receive too much attention. The nearer the site is to the homestead the greater will be the supervision the beds receive. The grower should visit the site at least twice daily to note the progress the seedlings are making and to see that they are being properly thinned out and that spraying operations with some fungicide such as Bordeaux mixture or Bouisol is being carried out at regular intervals and in an efficient manner.

At the time of transplanting experienced supervision is necessary to see that only healthy seedlings and plants of the correct size are being pulled.

The question of exposure is an important one. The beds should be so located that they receive a maximum amount of sunlight, particularly in the early mornings—eastern and north-eastern exposures are the best.

The site should be sheltered from the prevailing winds. Where no natural protection is afforded an artificial shelter consisting of long grass or reeds should be erected around the site leaving space for a gate on the side nearest to the water supply.

When selecting the site due consideration should be paid to the general nature of the terrain. Try and select a fairly level piece of ground or one with only a very gentle slope. As far as possible avoid steep slopes, but where this is impracticable the beds should be arranged in terraces and the necessary precautions should be taken to protect them from damage by surface wash from higher levels.

Wherever there is the slightest risk of the seed-beds being damaged by a rush of water during a storm, large ditches should be dug round the four sides of the site and an outlet for the water provided at the lowest point. Where artificial shelters are to be provided, space should be left for them between the drains and the actual seed-bed area.

Small drains are ineffective. The ditches should be large enough to properly protect the area. Their depth will depend upon the slope of the land, but they should be not less than three feet wide.

It might be impossible on some farms to find a site which incorporated these six major requirements, but such a difficulty can generally be overcome by realising that the texture of the soil for seed-beds can be greatly improved by judicial treatment.

For instance, if the soil is too heavy and stiff apply a few wagon loads of sand to the surface and mix it in to a depth of 6 to 8 inches. On the other hand, where the soil is too light and friable a treatment with a heavier type of soil will do much to improve the texture.

On no account in the following season should a site be used in which the seedlings of the previous season have shown signs of disease because, by so doing, the new plants are rendered more liable to attack by insects and bacterial and fungoid diseases which may have been carried over in the soil as a result of imperfect soil sterilisation.

The question of annual soil sterilisation by burning is in itself another reason for not making continuous use of the same site year after year. Unless strict and careful attention is paid to the amount of residual wood ash allowed to remain on the site there is the danger of an excess amount being incorporated in the soil, thus rendering it alkaline— a condition which is accentuated in this country by the high degree of the alkalinity of the water, particularly in certain areas, during seasons of late rainfall. ([4]).

Preparation of Seed-beds.([5])—The site should first be cleared of all vegetation and then be levelled. The area cleared should be in excess of the actual area required for the seed-beds so that a clear space surrounds the beds and so reduces the chances of incursion by insect pests and of the seeds of weeds being blown among the germinating tobacco seed. This work should be carried out during the winter months and some time previous to the final preparation of the beds so that sufficient time is allowed for the destruction of the natural vegetation by decomposition and dessication. The soil should also be worked at frequent intervals with this same object in view.

A few days before the date of seeding the site is lined off into beds with pathways between. The beds may be made any length desired but should not be wider than five feet, as a width greater than this renders it difficult for the labourer to attend to plants along the centre of the bed.

The pathways between the beds should be sufficiently wide to allow a workman ample space to move about freely and in comfort. Two feet six inches may be regarded as being convenient for this purpose.

If it is the intention of the grower to have his beds raised above the level of the pathways, the next operation will be to throw up soil from the pathway on to the adjoining area marked off for a seed-bed. If on the other hand the intention is to have the beds level with the path and to be bordered by bricks, then naturally this operation is omitted.

The soil for each seed-bed should next be worked to a fine tilth prior to being sterilised. In Southern Rhodesia the open fire method of sterilisation is the one adopted. The process consists of covering the entire site—seed-beds and pathways—with a layer of grass (to encourage conflagration) underlying a requisite amount of fuel. A layer of brushwood to a depth of about two feet or maize cobs to a depth of six inches is very satisfactory for this purpose. Tobacco stalks should not be used, as there is always the danger that they may be carrying diseased tissue, scraps of

which may fall in the immediate area surrounding the sterilised site and so be a source of infection, particularly of wildfire, angularspot and eelworm.

The best results are derived from sterilisation when the soil is in a moist condition and when burning is carried out on a calm day so that maximum benefit can be derived from the heat generated by the burning material. The soil should not be sterilised when it is saturated with water, nor, to obtain satisfactory results, should it be too dry.

A simple test described by Brown(5) to determine whether or not the soil has been properly sterilised, is to bury a potato about three inches below the surface of the soil in the seed-bed before burning. When the potato has been sufficiently cooked to allow the skin to be pealed off easily, the sterilisation may be considered to have been carried out sufficiently.

The secret of good sterilisation lies in arranging the fuel uniformly, to the depths previously suggested, over the entire surface of the soil and to carry out the burning on a calm day when there is no strong wind blowing and with the soil in a moist but not saturated condition.

After burning, the area is allowed to cool down and all the unburnt portions of the material used for sterilising the beds should be removed and the charcoal and ash should be scraped off so that there is not more than a uniform depth of half to one inch of ash remaining. Taylor(4) has described the danger which may result from incorporating an excess of ash with the soil, particularly in the case of seed-beds which are used year after year.

The next step is to border off each bed on all four sides with a single row of bricks placed on edge lengthwise. This practice is not esential where the beds are raised above the level of the paths, as in such case they are not liable to get damaged so easily by labourers walking about on the pathways between the beds and, also, they tend to absorb water more freely, but when the beds are made on level ground the brick border becomes a necessity, as not only does it assist in protecting the germinating seedlings from damage by insects and humans, but it also serves a most useful function in reducing the volume of water which would otherwise escape from the beds to the paths.

Once the grower is satisfied that the soil has been worked into a fairly fine tilth the beds may be regarded as ready for a dressing of fertiliser. The tilth on the actual surface of the bed should not be too fine and powdery, as in such condition the seed tends to get washed badly, resulting in a very uneven germination. On the other hand, if the soil particles are too large the condition is again undesirable. The best results in germination are obtained when the surface has a moderately rough appearance with no soil particles larger than a quarter of an inch in diamter, i.e., slightly smaller than an ordinary garden pea, but not pulverised into powder.

There are on the market a number of fertilisers specially prepared for use in tobacco seed-beds, but should the grower desire to mix his own fertiliser Brown(3) recommends the following formula:—

$\frac{1}{2}$ lb. nitrate of soda.
$\frac{1}{2}$ lb. sulphate of potash.
1 lb. superphosphate.

Mix thoroughly.

The above quantities when mixed together are sufficient for 10 square yards of seed-bed. The fertiliser should be broadcast evenly over the surface of the bed and should then be thoroughly incorporated with the top three inches of soil—care being taken not to bring unsterilised soil to the surface, as this would vitiate the good done by sterilising. After raking over thoroughly to ensure that the surface is level and the tilth satisfactory the bed may be regarded as ready for sowing.

An allowance of 100 square yards of seed-bed should be made for each acre of tobacco it is intended to plant in the field.

Turkish seed-beds are normally sown from the beginning of December to the middle of January.

It has become the practice on some farms on which both Virginia and Turkish are grown to make use of the Virginia beds for the sowing of Turkish, but this practice can only be considered permissable when the grower has made absolutely certain that there was no sign of disease such as wildfire, mosaic, frog-eye, angularspot or nematode in the Virginia seedlings. This site should be re-sterilised before being sown to Turkish.

Tobacco seed should always be cleaned of all chaff and dirt adhering to it and should then be treated with a suitable chemical, such as a solution of silver nitrate, to destroy bacteria which may cause an outbreak of wildfire and angularspot.

Tobacco growers may avail themselves at small cost of the services offered by the Chemistry Division of the Department of Agriculture in connection with the cleaning and treating of seed.

It is unwise to sow seed too thickly, as the resulting growth is far too dense and the seedlings become long and lanky instead of being sturdy little plants. Also, too dense a growth calls for additional thinning out, and this in turn not only loosens the soil around the remaining plants but it may also lead to certain disease being transmitted to the beds by the medium of the " boys' " hands. For instance, it is known that the mosaic virus can be carried over in snuff made from mosaic infected leaf, so that a person who has been handling such material is a source of danger to the tobacco seedlings. Within reason, the less the plants are handled the better.

Generally speaking, one heaped teaspoonful of cleaned and treated seed of good germinating capacity is sufficient to sow 25 square yards of seed-bed. This amount is, or course, a variable one. Experienced growers may get good results by using slightly less, whereas others may require to use more.

Tobacco seed is so small that unless it is " carried " in some other medium such as finely sieved ash, mealie meal, sand or water, it is impossible to broadcast such a small quantity over a large area.

Mealie meal, ash and a light coloured sand are all ideal for this purpose, as when broadcast they show up well on the surface

of the bed and so serve as indicators of the uniformity of the sowing. They should be in a thoroughly dry condition and, in the case of ash and sand, should first be passed through a sieve of fine mesh. When sand is being used, care should be taken to see that it has been obtained from a depth of more than two feet below the surface of the ground, otherwise there is a danger of the seeds and roots of weeds, particularly of grasses, being transmitted to the beds where, under the ideal conditions pertaining, they make take root and so prove a menace.

In using one of these solid distributing mediums the procedure is to place a sufficient quantity of the ash, mealie meal or sand for one seed-bed in an enamel dish or other suitable container and over the levelled surface to carefully and uniformly sprinkle half the requisite amount of seed, thoroughly mixing it into the medium. Repeat the procedure using the remainder of the seed. Broadcast carefully over the bed.

When using water as the carrying medium, the seed is merely added to the water in the can, thoroughly stirred with a stick and sprayed on to the bed. This method does not give as good results as are obtained by using ash, sand or mealie meal, as the tiny seeds tend to adhere to the sides and top of the can and, unless properly stirred—even during the actual process of watering on to the bed—the distribution is not as uniform as might be desired and cannot be detected at the time as readily as in the case of the light coloured solid.

Immediately after the seed has been sown the bed should be thoroughly watered, using a watering can fitted with a fine rose. Next cover with cheese cloth or grass.

When the latter is being used, a fairly thin layer of reeds are tied to a framework of horizontal sticks which are supported on Y-shaped wooden props about a foot high and driven vertically into the ground at appropriate intervals along the edges of the bed. As the seedlings become established and require more and more sunlight the grass is gradually thinned out and in the final stages the frames can be removed during the day and brought into use again at night or during heavy rain.

Cheese cloth, however, allows of more rapid germination and development and looks far neater than does grass. Its use is, therefore, advocated whenever conditions permit.

A wire is stretched along the centre of the bed from one end to the other and is supported about 14 inches above ground level by means of wooden pegs driven into the ground at suitable intervals of, say, ten feet. To this wire the cloth is attached by being tied along its centre seam with loops of twine. The edges of the cloth are left free so that when not in use the two sides can be rolled up and laid along the wire. When required to shelter the seedlings, however, the sides are rolled down and held in position along the edges of the bed by bricks being placed on the edge of the cloth at intervals of about eighteen inches or less.

In addition to the other advantages already enumerated, cheese cloth does not harbour insects as readily as does grass, it can be handled more easily, it permits a better distribution of sunlight and, if given reasonable care, it can be used for a number

of seasons. Before being used again, however, it should always be sterilised against fungoid and bacterial organisms by boiling thoroughly in water.

Seed-beds must receive unremitting care and attention. The soil should never be allowed to dry out but should always be kept in a nice, moist and friable condition.

At first the beds should be kept covered the whole time, except of course for the short periods when they must be uncovered for watering. Later when the seedlings have grown a little, they may be exposed to the early morning and late afternoon sun. The period of exposure is gradually increased each day so that by the time the plants are the correct size for transplanting (4-6 inches in height), the covers are left off all day and used only at night or when a storm is threatening.

The amount of water applied to the beds should be gradually reduced so that by the time the plants are 4-6 inches high they are only receiving sufficient to keep them from wilting.

In view of the existing difficulty experienced in obtaining supplies of cheese-cloth and also the fact that seed-beds for Turkish tobacco are sown during the wettest period of the season, it is recommended that long, clean grass or sunnhemp stalks be used as a covering in place of cheese-cloth. The grass or sunnhemp covering is placed on a framework erected over each bed as already described.

A combination of these two effects, viz., increased exposure and reduced moisture content, will help to harden the plants and thus enable them to stand up better to transplanting conditions.

The beds should be kept free of weeds and grasses and the plants should be thinned out sufficiently to allow the remaining ones to receive ample air and light. The advice on hygiene and control of diseases described by J. C. F. Hopkins, Plant Pathologist, in Bulletin No. 653, and in his book "Diseases of Tobacco in Southern Rhodesia," should be strictly observed.

Should the plants fail to make satisfactory progress, an immediate attempt must be made to try and ascertain the cause. It will probably be due to disease, insect pests or unsatisfactory soil conditions. Generally, a sickly yellow appearance indicates lack of plant food, particularly of nitrogen.

Nitrogen deficiency may be made up by a suitable application of nitrate of soda. Dissolve 1 lb. of nitrate of soda in 8 gallons of water and apply to about 20 square yards of seed-bed surface([2]). A more complete food, however, is provided by liquid fowl manure. Brown([2]) describes the preparation and use of it as follows: "Take a suitable receptacle and half fill it with fowl manure. To this add sufficient water to fill the receptacle. The receptacle should be allowed to stand for about 5 or 6 days, and its contents frequently stirred at regular intervals. After standing for this period, the liquid manure is ready for use. One gallon of liquid fowl manure is diluted in eight gallons of water; this should be applied to ten square yards. A second application of liquid fowl manure may be given a few days after the first application . ."

"Immediately after the application of nitrate of soda and liquid fowl manure, the beds should be watered to wash the solutions from the plants and so prevent the leaves of the seedlings being burned. When possible, application should be made on a dull, cloudy day, so as to reduce the danger of the leaves being scorched."

"None of the above should be applied to young seedlings with leaves smaller than a threepenny coin, as the young seedlings would be damaged by the solution."

Rotation of Crops.—In this Colony Turkish tobacco seldom features on the farm as the principal item of field husbandry. In the vast majority of cases it is grown in conjunction with Virginia flue-cured tobacco because a combination of the two constitutes an ideal economic unit on the farm by providing work throughout the year, not only for the large staff of natives employed but also for the more highly paid European supervisors.

In addition, the one generally offsets any financial loss that might be sustained through the other, for it is seldom that adverse climatic conditions will effect both crops, seeing that the times of planting are widely spaced—Virginia being planted from November to December and perhaps January, and Turkish from January to March.

The best quality leaf is always obtained from a crop grown on virgin soil. It is not advisable to grow more than two crops of tobacco in successive seasons on the same soil, as the leaf of subsequent crops tends to be harsh in texture. This calls for the adoption on the farm of some suitable system of crop rotation.

The theory of rotation is based upon the different proportions of nutrient materials absorbed by plants, on the presence of matter from the decay of plants and on the excretions from growing plants which may poison the soil for plants botanically related to them and following immediately after.

It is the root range of a plant which large determines the food requirements of the plant. Some crops, like tobacco for instance, are deep-rooted and will procure their food requirements from a greater depth, and consequently a greater area of soil than will a more shallow-rooted crop such as maize. In rotation, therefore, better balance is maintained amongst the nutrient substances in the soil because there is a range of crops demanding different proportions of plant food.

There is also considerable variation in the effects produced in the soil by different crops. For instance, legumes add nitrogen to it, whereas cereals tend to use it up; fibrous and fine-rooted crops such as grasses and cereals exert a beneficial effect on the mechanical condition of the soil, whereas root crops and potatoes use up humus and so tend to leave the soil in a relatively poor physical condition.

Another advantage of rotations is that they minimise the risk from plant diseases and insect pests, and in doing so serve as a useful measure of control. The root-knot nematode (*Heterodera marioni*) will flourish on tobacco but it will not touch grasses; therefore in a nematode-infested soil, the production for a number of years of crops resistant to nematode attack will tend to starve out the pest.

The choice of a rotation for any particular farm will depend upon a great number of factors, the principal ones being the suitability of soil and climate to the different crops the farmer has in mind, the economic value of the different crops, the distance of the farm from marketing centres and the susceptibility of the different crops to fungoid and bacterial diseases and to insect attack.

In this Colony there is still much room for experimentation in connection with rotation of crops on tobacco soils, but the following suggestions may prove helpful:—

1 *Five-course Rotation*

1st year (virgin soil)	Tobacco, either Virginia or Turkish.
2nd ,,	Tobacco, either Virginia or Turkish.
3rd ,,	Maize (or similar crop).
4th ,,	Legume ploughed under.
5th ,,	Maize (or similar crop).
Repeat.	

2 *Six-course Rotation*

1st year (virgin soil)	Tobacco, either Virginia or Turkish.
2nd ,,	Tobacco, either Virginia or Turkish.
3rd ,,	Groundnuts.
4th ,,	Legume ploughed under.
5th ,,	Maize.
6th ,,	Grass.
Repeat.	

3 *Six-course Rotation*

1st year (virgin soil)	Tobacco, either Virginia or Turkish.
2nd ,,	Tobacco, either Virginia or Turkish.
3rd ,,	Legumes ploughed under.
4th ,,	Maize.
5th ,,	Grass; or allowed to revert to natural vegetation.
6th ,,	Grass; or allowed to revert to natural vegetation.
Repeat.	

4 *Six-course Rotation*

1st year (virgin soil)	Tobacco, either Virginia or Turkish.
2nd ,,	Tobacco, either Virginia or Turkish.
3rd ,,	Maize.
4th ,,	Legume ploughed under.
5th ,,	Grass; or allowed to revert to natural vegetation.
6th ,,	Grass; or allowed to revert to natural vegetation.
Repeat.	

In each of the above examples the rotation has commenced with virgin soil being planted to tobacco. This, however, is not a necessary procedure and should not deter persons who have no virgin soil available from growing tobacco. As previously mentioned, however, the best quality Turkish leaf is always obtained from a crop grown on virgin soil, and for this reason, whenever farming conditions will allow, virgin soil should be reserved for the Turkish crop.

There is a large choice of legumes open to the farmer for green manuring purposes, but owing to the serious incidence of root-knot nematode (7), it is advisable that his selection be restricted to legumes resistant to eelworm attack.

The following is a short list of plants of economic importance known to be resistant to eelworm infestation:—

Velvet Beans.—Florida, Mauritius, Somerset.

Cowpeas.—Monetta (almost invariably), Brabham, and varieties of Victor and Iron.

Sunnhemp.

Maize.

Munga.

Oats.

Soya Bean.—Laredo variety.

Wintersome.

Peanuts.—Most varieties, including Valencia, Virginia, Bunch, Masimbika, Jumbo.

Grasses.—All species.

It has been found(7) that by growing tobacco on land known to be infested with *H. marioni* the infestation can be increased by ninety per cent. in a single favourable year. Infested lands should therefore not be planted to susceptible crops.

Preparation of the Land.—As this aspect of the subject has been fully dealt with by Brown in his Bulletin(6), there is no need for further elaboration, but for convenience of reference his views are quoted verbatim hereunder.

" It is essential that, after being transplanted, the tobacco should make rapid and continuous growth. The field should, therefore, be properly prepared and the soil should be brought into as perfect a tilth as possible.

" In preparing virgin soil, it is desirable that the land be stumped, cleared and ploughed during the preceding rainy season. Stumping is best done during the months of the heaviest rainfall, when the soil is thoroughly soft. A point to be remembered when stumping and clearing new land is that timber should be drawn off the field, not piled there and burnt. If burnt on the field, the heavy ash residues left on the land will give rise to an uneven crop of tobacco. The newly-cleared field should be ploughed—usually about March and April—while the grass and vegetation are still green and full of moisture, and before the soil becomes too dry or hard.

" When handled in this maner it will be found that the land can be more thoroughly ploughed; all vegetation turned under is more readily decomposed and converted into humus, and the soil is rendered more friable and retentive of moisture. After lying fallow during the winter months, the land should be ploughed and cross-ploughed, and then harrowed with a heavy disc-harrow, being finally brought into a good tilth by means of drag harrows.

" Generally speaking, the tobacco soils of Southern Rhodesia are inclined to be rather shallow, and great care should therefore

be taken in the ploughing operations, so that only the top-soil is turned over by the plough. A quantity of the sub-soil brought to the surface through ploughing too deeply will have a detrimental effect on the crop.

"Land which has already been under crop should, if possible, be ploughed as soon as the crop is harvested, so that a certain amount of soil moisture may be conserved and also to assist in the destruction of insect pests which may be hibernating in the soil. Such soils should be ploughed again during the early part of the following season, and brought into good tilth just prior to planting.

"With all soils, whether virgin or previously cropped, it is imperative to secure a good tilth before planting. Whenever possible, the final ploughing and harrowing should be made when the soil has been moistened by showers of rain which fall at the commencement of the wet season, since any weeds coming up at this time will thus be destroyed, and subsequent weeding will be reduced to a minimum.

"Suitable drains should be made where necessary to lead off storm water. Around each field a strip of ground (say, 20 feet wide), kept free from weeds and grass, will assist in checking insect pests. When the outer edges of the fields are straight, and suitable pathways are left at convenient intervals across the field, a good deal of time and damage will be saved during the working of the crop."

Manurial Treatment.—Owing to the variation which exists not only in the type of soil used, but more so in the degree of fertility of those different soils, it is not possible in a work of this description to deal separately with the fertiliser requirements of each type. The intention here is to treat that subject in a very general manner.

First and foremost, as has been previously pointed out under the heading of "Soils," it is necessary to select a well-drained, deep, fertile, light bodied soil. One lacking in humus will tend to produce leaf harsh in texture and lacking in oil.

The average soil in this Colony suited to the production of Turkish type tobacco has a requirement of some 175 lbs. per acre of a fertiliser of composition 3 per cent. nitrogen, 9 per cent. phosphoric oxide and 9 per cent. potash. The fertiliser is applied broadcast and is harrowed into the soil before planting operations commence.

Alternatively the fertiliser may be broadcast about three weeks after the crop is transplanted in the field. This method is considered advisable when the weather is excessively wet, in order to minimise the loss of fertiliser which might otherwise take place through leaching from the soil.

Experiments with the use of compost are in course of trial and it is hoped that this material will prove useful in building up and maintaining the humus content of our tobacco soils.

Transplanting Operations.—It has been found from experience that the best results are obtained from fields which are planted between mid-January and mid-February. The optimum size of

seedling for transplanting purposes is one of about six inches in height. The seedlings should not be less than four inches tall, as very small plants seldom make good progress owing to their extreme tenderness. A few hours of strong sunshine before they have had time to establish themselves will cause them to wither and die. Also, a very heavy downpour of rain will tend to batter them down so that they become buried in the soil. On the other hand large, tough, woody, overgrown plants seldom grow out well when planted in the lands, and so the grower should avoid the temptation of making use of these overgrown seedlings, no matter how healthy they may look in the seed-beds.

Method of Transplanting.—Transplanting is best done on days when the sky is overcast and there are frequent showers of rain. Such ideal conditions are not always obtaining, however, so that the time of transplanting will depend, in the main, on the moisture content of the soil. It is unwise to transplant tobacco seedlings unless the soil is sufficiently moist to prevent them from wilting. Generally speaking, do not transplant unless at least the top three inches of soil are in a moist condition. Provided the soil is sufficiently moist, tobacco may be transplanted throughout the day, but the best time is during the cool hours of the afternoon.

It should always be remembered that the little transplants are very tender and must not be subjected to any hardships which can be avoided. For instance, if at the time of removal of the seedlings, the soil of the bed appears to be dry, it should be well watered so that it becomes nice and soft before the plants are actually pulled. This will reduce to a minimum the chances of injury occurring to the roots and young leaves.

When carting the young transplants from the seed-beds to the field, they should not be exposed to the full rays of the sun but should be covered with hessian or other suitable material.

In this Colony the spacing normally employed for Turkish type tobacco is 18 inches by 9 inches. That is the rows of plants are 18 inches apart while the plants in the row are spaced 9 inches apart. Such spacing demands approximately 39,200 plants per acre, that is, eight times as many plants as are required for Virginia flue-cured tobacco when spaced 3 feet by 3 feet.

It is apparent, therefore, that to use the same method to mark out a land for Turkish type as one does for Virginia—that is, to indicate the proposed position of each plant by inserting the stem of a grass at that point—would be a very laborious task indeed, particularly where it is intended to plant large acreages. This operation has been much simplified by the use of the "dundoo," or marking frame.

The "dundoo" as the natives call it, is a home-made implement of very simple construction and design. It merely consists of a frame comprising four or five upright straight sticks five feet high and 1½ inches in diameter, separated from each other by distances of exactly 18 inches and held together firmly in position by three horizontal bars. The lowest of these bars is fastened to the uprights at a height of 12 inches above ground level, and the topmost one 3 inches below the tops of the uprights. The remaining one is fastened in between these two. Their function is merely to keep the uprights firm and spaced at intervals of 18 inches. To

ensure greater rigidity the frame may be supported by two more supports fastened crosswise. The lower ends of the four or five uprights should be pointed and preferably be fitted with steel ferrules.

The implement is used in conjunction with a wire marked off at intervals of 9 inches, i.e., the distance required between the plants. The wire is first placed along the top edge of the field and drawn taut; two natives then walk along the length of the wire holding the dundoo between them at right angles to the wire. When level with each mark on the wire, they bang the dundoo down into the soft moist soil, thus not only marking off the position, but also making a suitable hole for the intended transplant. When they have reached the last mark, the wire is lifted and pulled taut along the last line of holes made by the dundoo, and the process is repeated until the entire field has been marked off.

The combined operation of marking and dibbling is immediately followed by the actual transplanting. The tap root should go straight down into the soil, as a bent tap-root is liable to interfere with the satisfactory growth of the plant. Excessively long tap-roots should be nipped off to a convenient length.

Do not allow the " heart " of the plant to get buried under the soil and do make sure that the soil around the plant is pressed down well. Native labourers are apt to overlook the importance of this operation, and as a result the transplant does not take hold satisfactorily. It is impossible to keep a strict check on the work of each native, but the grower should satisfy himself by occasionally taking hold of two or three or the larger leaves of the plant between his finger and thumb and giving a gentle pull upwards. If the plant does not shift, it means that the soil around it has been pressed down properly.

A few days after transplanting, gaps will be observed in the field due to plants having died as a result of inherent weakness in the plant itself or to adverse climatic conditions or to depredations by insects. These gaps should be refilled as soon as possible, because the more perfect the stand the greater the financial gain. Refilling should not be delayed more than a few days after transplanting has been completed, because otherwise the refills will be considerably more backward than the original plantings and so result in unevenness in time of ripening.

Cultivation.—Cultivation should commence as soon as the plants have become established in the field. The first cultivation should be shallow and carried out by hand so that the young plants will not be injured or disturbed. Later on a single tine cultivator may be employed, but its use must be discontinued as soon as the plants have grown out a bit and the leaves are liable to get damaged. Subsequent cultivation should be shallow and done by hand. The field should at all times be kept free of weeds and a light surface mulch should be maintained to reduce loss of soil moisture by evaporation and to allow of satisfactory aeration of the soil.

The drawing of soil to the stem of the plants at each cultural operation is also important, since it allows of more plant food being placed within easy reach of the feeding roots.

All cultivation should cease as soon as the plants begin to come into flower, as disturbing the plants after this stage will delay maturity and cause dust to adhere to the leaf.

Priming.—The lowest leaves on tobacco plants are too thin and papery to ever cure into good quality tobacco, also they are an imminent source of danger, because being near the ground they attract insects, and it has also been found that diseases generally commence in them and then spread to the higher parts of the plant. Furthermore, the food materials translocated to them would be used to far greater advantage by leaves of better quality borne higher on the plant. For these reasons all lower leaves which tend to touch the ground should be removed or " primed " off.

The operation should be delayed until about a month after transplanting, as this period gives any disease which may be developing in the leaf time in which to make itself apparent and so enable the grower to avoid transmitting it by hand to healthy plants.

It is always good practice to send through the field a gang of labourers whose duty it is to remove diseased leaf only. They should receive implicit instructions not to touch healthy plants. They are immediately followed by another gang who prime only healthy plants. In this way the possibility of spreading infection by hand from diseased to healthy plants is reduced to a minimum.

Topping and Suckering.—Turkish type tobacco does not require to be topped.

It is unusual for suckers to make an appearance, but in certain seasons of heavy rainfall, particularly at a time when the plants are reaching maturity, it sometimes happens that they do appear, and when this occurs, it is necessary that they be removed.

Ripening.—Too much emphasis cannot be laid on the fact that the finest flavour and smoking quality of the cured leaf is due to the natural changes which occur in ripening while the leaf remains on the plant.

As in the case of cereals, there are various stages of ripeness. It follows therefore that the leaf must be picked at the correct stage of ripeness. If the leaf is harvested when under ripe, that is on the green side, the cured product will be dark in colour and bitter in flavour. On the other hand, over-ripe leaf will cure out thin and papery and be lacking in flavour and aroma.

When a leaf is allowed to remain on the tobacco plant beyond the stage of ripeness at which it should be reaped, a bright yellow colour suggestive of full ripeness will commence to show at the tip and then gradually spread over the entire surface of the leaf. As this bright yellow colour spreads, it will be followed by a browning indicative of decay, so that before the portion of the leaf closest to the stem has become fully ripe, the opposite extremity has already commenced to decay. This implies that the leaf must be reaped before this stage of " full " ripeness has been reached.

As with maize and other plants, the leaves of a tobacco plant ripen progressively from the base of the plant upwards. The number of leaves on an individual plant ready for harvesting at the one time varies considerably; there may be only the one or there

may be as many as five or six, but, generally speaking, three or four reach the correct degree of maturity simultaneously.

During growth the leaves are soft and pliable and of a deep green colour. As the plant grows, however, the leaves increase in surface area and thickness due to the accumulation of food material.

When the leaf has reached full growth, from being soft and pliable, it becomes somewhat rough and brittle, due principally to the accumulation of starch granules in the cells.

Though the leaf is now fully grown, it does not mean that it is necessarily ripe enough for harvesting. As in the case of an apple tree, although the fruit may have become fully developed, it is not ready for picking until there is an indication of change of colour, so in the case of the tobacco leaf the grower must await a yellowing.

The colour of the leaf will gradually transform from a comparatively deep green to a greenish yellow. The change will first be observed in the region of the tips and edges of the leaf and from there will gradually extend inwards. This yellowing will be more pronounced in light bodied leaf. In leaf of heavy texture the correct degree of ripeness will be indicated by the appearance of yellow flecks over the surface and by the brittleness of the veins and mid-rib. If a portion of the leaf is pressed between finger and thumb, it should crack across the fold.

Perhaps the best indications of ripeness are a definite change of colour in that portion of the leaf closest to the stalk of the plant, coupled with a tendency for the leaf to bend over in the direction of the ground or to assume a slightly horizontal position.

Again emphasis is laid on the important bearing that the correct degree of ripeness has on the colour and quality of the cured product. In determining ripeness no indicative factor should be considered separately, but all the characteristics referred to above should be considered collectively.

Harvesting.—Turkish type tobacco is harvested by the single leaf method. That is, as a leaf reaches the correct degree of ripeness on the plant, it is picked and cured.

Harvesting should be done in the early hours of the morning before the sun has had time to cause the plants to wilt. If there should have been heavy dew during the night, picking should be delayed sufficiently long to allow the leaves to dry.

On no account should leaf be harvested immediately after a heavy shower of rain, as the gum which accumulates on the leaf during dry weather and improves its quality, is washed off by the rain. It is not always possible, but when circumstances permit, it is beneficial to delay reaping for a day or two after a heavy downpour.

When there is not much variation in the character of the soil of a particular field and where seedlings of uniform size were transplanted and uniform growth has been made, harvesting will be much facilitated, as at each picking approximately the same number of leaves can be reaped from the different plants, and as these leaves will occupy approximately the same positions on the

plants, they will aproximate each other in size and texture which will be a great advantage in curing and will greatly facilitate grading.

At all times great care should be exercised in handling tobacco leaf. At the harvesting stage it is very tender and crisp and will be easily bruised if not properly handled.

As soon as the leaves have been harvested, they are carefully laid in the small baskets made by the labourers on the farm and are carried to the homestead. The baskets should be covered with cloth or other suitable covering material to protect the leaves from the sun.

Stringing and Preliminary Grading.—In some shady spot such as a shed or under a tree or in an improvised grass shelter, the leaves are roughly graded according to size and colour. All diseased, perished and damaged leaf is put to one side and graded separately. This preliminary grading does not take up much time and through it a much more uniform cure of the different types of leaf is attained, thus effecting a considerable saving of time and labour when it comes to grading the cured product.

Stringing is the next operation. It is done with the aid of a thin flat steel needle from 18 to 26 inches long threaded through the eye with good quality twine.

The needle is passed through the mid-rib of each leaf separately and about half an inch from the butt. All leaves should face the same way and only leaves of the one grade should appear on the needle. When the needle has its full complement of leaves, the latter are carefully moved along on to the string and the operation is repeated. Strings are normally cut to lengths of about nine feet and carry three 24-inch needles full of leaf. This quantity allows plenty of space for manipulating the leaf on the string during curing operations.

Curing.—In former times there was a ready demand for leaf dark in colour. To-day, however, the manufacturer requires leaf varying in colour from lemon to light mahogany, and as a result of this change in demand the grower no longer makes use of a cellar or wilting room before placing the strings of tobacco on the curing racks, as that practice resulted in the leaf sweating and curing out dark.

Now, as soon as stringing has been completed, the strings are tied on to the curing racks. These racks are constructed in a locality sheltered from the prevailing winds but fully exposed to the sun. There should be no tall trees or buildings in the immediate vicinity, as they would produce shadows over portions of the curing tobacco and so hamper uniform curing, since some strings would receive considerably more direct sunlight than others.

The curing racks consist of two parallel rows of short stout poles about five feet long let vertically into the ground to a depth of two feet. A convenient distance between the rows is three feet; it should not exceed more than four feet because, if too wide, the labourer finds difficulty in manipulating strings along the centre of the rack and in endeavouring to reach them may damage the outside rows.

The posts in the line should be spaced about eight feet six inches apart. The construction of the rack is completed by stretching heavy gauge wire over the tops of the posts from one end of the line to the other.

Briefly, the rack comprises two parallel strands of wire drawn taut and supported by stout vertical poles at a height of about three feet above ground level. The rack may be made any length desired but should not exceed four feet in width. Preferably the racks should run in a north and south direction, so that the leaves on them will receive a maximum amount of sun.

Across the two wires at distances of about eight feet six inches, straight sticks are fastened firmly. To these the laden strings are tied in rows parallel to the wires.

The parallel strings of tobacco should be tied sufficiently far apart to prevent the leaves of one string coming in contact with those of another. This will reduce the risk of excess fermentation setting in and will allow of sun and air reaching the leaves on each string.

The principles underlying the curing of Turkish tobacco are the same as those employed in curing flue-cured Virginia. In the case of the latter, however, the grower is in a much more fortunate position in that the leaf is cured in barns with the aid of artificial heat so that he has a relatively easy task in obtaining the requisite degrees of humidity and temperature. In the case of Turkish, however, curing is done in the open, and as the grower has no control over the climatic elements, he has to regulate the rate of cure by manipulating the leaves on the strings.

Curing differs from a true drying problem in that it is a physiological process involving both physical and chemical changes in the leaf. ([9]).

In an article of this nature there is no room to elaborate on scientific detail but suffice to say that in curing there are three essential stages—the yellowing period, the fixing period and the drying period.

1. *The Yellowing Period.*—During the life of the plant, food material is stored in the leaf. In the curing process this food is consumed and the chlorophyll (green colouring matter) undergoes chemical action resulting in a change in the colour of the leaf from green to yellow. This process can only be carried out while the leaf is alive, and it follows, therefore, that one must guard against excessive elimination of water or moisture, for water is essential to life.

This yellowing period is of vital importance in curing, because on it depends the colour and quality of the final product. If the leaf is allowed to dry out too quickly, the cells will be killed and the necessary change in colour will be prevented.

2. *The Fixing Period.*—Once the colour of the leaf has changed from green to lemon, it is necessary that the action be restricted from proceeding any further, otherwise the leaf will tend to cure out too dark in colour. This is done by eliminating water from the leaf tissue; in other words, by allowing the leaf gradually to dry out. The leaf may now be considered killed.

3. *The Drying Period.*—This resolves itself into a true drying stage. Although the leaf has been killed through the removal of most of its moisture during the fixing period, a certain amount of water will still be held in the mid-rib, and this must be got rid of completely before the leaf is removed from the racks, otherwise the tobacco will be rendered valueless as a result of excessive fermentation setting in during storage.

To put these principles into practice the following procedure is adopted. Immediately after the laden strings have been tied on to the curing rack in the manner previously described, they are covered with a layer of loose grass or hay to a depth of about 12 inches.

The grass will be left on the rack for two or three days, depending upon the humidity of the atmosphere and the rate at which the change in colour is taking place. At the commencement of the curing season when the atmosphere is fairly humid, it may be necessary only to cover the leaf for the first day and thereafter only during the hottest hours of the day, but as the season progresses, the grass will have to be left on for considerably longer.

Experience gained during recent years has called for some modification in curing methods and, except in the case of very unripe leaf, the wilting period has now been reduced to less than twenty-four hours. Under this new method, the tobacco is placed on the racks during the late afternoon and covered over in the usual way. The leaves are kept packed close on the string until the following morning, when the covering is removed and the leaves separated and spaced along the full length length of the string.

Once the appropriate colour changes have taken place, the yellow must be fixed by the water in the leaf tissues being gradually eliminated. Consequently the grass is removed in the early mornings and replaced at night. This operation is continued daily until the leaf has been completely dried.

The importance attached to preliminary grading before stringing will be fully appreciated during curing operations. If all leaves on the string are of the same size, colour and texture, and if all neighbouring strings on the curing rack are of similar grade, then the leaves will tend to cure out uniformly. If, on the other hand, sufficient attention has not been paid to preliminary grading and to maintaining a uniformity in type of the neighbouring strings on the rack, then considerable difficulty in curing will be experienced, for some leaves will be curing out faster than others and, as it will not be possible to vary the curing for each, much loss will be sustained in the quality of the final product. The difficulty will not only rest at curing but will also make itself felt at the final grading.

Just as in flue-curing, so in the curing of Turkish, unless strict attention is paid, the leaf will tend to sponge or sweat owing to mositure collecting on the surface and causing excessive oxidation.

Sponging or sweating in Turkish tobacco is generally indicated by a dark reddish brown colour appearing near the butt of the leaf

and gradually extending along both sides of the mid-rib. If not checked in time, the entire leaf wil take on an unpleasant dark appearance.

In flue-curing operations this trouble may be overcome by reducing the humidity of the barn and by increasing the ventilation. In sun-curing the parallel procedure is to manipulate the leaf. For instance, as soon as the leaf is observed to be sponging or sweating the leaves on the string should be separated from each other just a little so as to allow more air to play through them and thus induce more rapid drying. Care should be taken not to separate the leaves too far apart, as that would result in the leaf drying out excessively fast and adversely affecting quality.

As indicated previously under the heading of "Climate," the incidence of rain may cause considerable damage to leaf on the curing rack. Whenever a heavy shower is threatening it is advisable to carefully transfer the strings to some suitable shed and keep them there during such time as the storm lasts. Such action, however, is not always possible, particularly when dealing with a very large number of strings, and in such cases the only course open to the grower is to protect the leaf on the rack by covering it with a particularly thick layer of loose grass. Remove the wet grass as soon as the rain has ceased.

Ideal protection is, of course, provided by canvas shelters fitted with rollers and erected over the racks so that the covering can be raised or lowered as climatic conditions determine. Canvas, however, is a relatively expensive item in this Colony, and in consequence recourse is almost universally made to grass.

As dew also everts a detrimental effect on the leaf by causing it to discolour, the covering of grass which has been removed in the morning should invariably be replaced at night. Always see that the grass overlaps the sides of the rack and so protects the outside rows of strings.

The leaf should remain on the rack until all moisture has been completely removed not only from the web of the leaf but also from the mid-rib. The time taken to reach this stage will vary from two weeks to about six weeks from the time the leaf was first placed on the rack.

Curing takes considerably longer at the end of the season than it does in April and May owing to the atmosphere being drier and the nights so much colder.

Handling and Grading Cured Leaf.—The best time of day for removing the cured leaf from the racks is in the early hours of the morning when the leaf is soft and pliable owing to the moist conditions pertaining overnight. If removed during the heat of the day the leaf is brittle and as a result much loss will be sustained through damage incurred in handling.

As the strings are removed from the racks they should be suspended from the roof of a shed or from the tiers of a tobacco barn, either in the form of wreaths or hanging straight down, or in any other convenient manner.

When required for grading, the brittle leaf is again brought into condition suitable for safe handling by introducing moisture

into the building in which it has been stored. This is done by placing a layer of grass to a depth of six or eight inches on the floor and wetting thoroughly with water. Keeping the doors of the building open overnight will tend to hasten the operation.

Steam has a detrimental ffect on the quality of Turkish leaf: its use for conditioning purposes is therefore not advocated.

In grading, each string should be manipulated separately. All leaf foreign to the general run of the strings should be removed so that on the string there remain only leaves which are similar in size, colour and texture.

If the preliminary grading before stringing was carried out properly and due attention was paid to keeping only strings bearing leaves similar in size, colour and texture contiguous to each other on the curing rack, and if a similar precaution was taken when transferring the cured strings from the racks to the storage room, then little or no difficulty will be experienced at this final grading.

All leaves removed from the strings should be graded according to size, colour and texture and be baled as loose leaf.

During the growth of the plant in the field, a certain amount of sand adheres to the surface of the leaf, particularly to leaves at the base of the plant. Similarly dust and bits of grass, etc., find their way into the strings on the curing racks. At the time of final grading, therefore, it becomes necessary to remove all foreign matter.

Grass and straw are best removed by hand, whilst sand and dust may be got rid of by shaking the strings. Particularly dirty leaves will require to be cleaned with monkey-tail brushes.

The standard of cleanliness required will be determined by the channel through which the tobacco is to be marketed. For instance, the Turkish Tobacco Co-operative Company of Rhodesia, Limited, requires its members to merely shake out as much foreign matter as possible but not to go to the trouble of brushing each leaf, the idea being to minimise working costs on the farm seeing that the tobacco will ultimately be thoroughly cleaned by hand and machinery at the Company's warehouse before it is blended and shipped for export. On the other hand certain brokers will not touch leaf which has not been brushed, whereas others again will be prepared to handle uncleaned and even ungraded leaf.

This last method of disposal may appeal to certain people, particularly to beginners in the industry who may be doubtful of their capabilities in handling leaf, but they should always remember that brokers and buyers are not philanthropists but business men and that when quoting prices they will always take into account the amount of foreign matter contained in the bale. The buyer cannot be expected to pay for sand and grass. Generally speaking, it will always pay the grower to make a really good job of the work himself. Grading is not a difficult problem if the few suggestions previously referred to are observed.

The work is simplified even further if, instead of using tables, the strings are suspended parallel to the ground and at a convenient height (eye level) between two vertical poles let into the floor

of the grading shed. The poles should be sufficiently far apart to just allow of the strings being tied to them. The grader, after shaking the string two or three times, ties it to the two poles and proceeds to grade. Each time he pulls off a leaf he automatically jerks the string, thus causing more dust to be shaken out. As leaves foreign to the general run of the string are removed from it, they are dropped into separate baskets (placed on the ground) according to their respective grades. Before untying the string the grader should satisfy himself that no straw or grass is remaining and then twang the string between finger and thumb to shake off more loose sand. As previously stated, any leaf which is particularly dirty and which does not respond satisfactorily to this simple treatment should be cleaned by brushing.

The loose leaf contained in the baskets should be subjected to a further inspection—this time on grading tables—to ensure that it has been properly sorted into its appropriate grades.

When a sufficient quantity of leaf has been cleaned and graded it is brought into suitable condition for handling and storage by subjecting it to fairly moist atmospheric conditions. It is then packed in the form of bales.

Baling.—There are three systems of baling open to the grower, and here again choice is determined by the channel through which the tobacco is to be marketed.

1. Certain buyers require the bale to be tonga packed. Tonga packing means that the graded and cleaned leaf is removed from the strings and "poured" into the baling box regardless of the direction in which tips, butts and surfaces are pointing. The leaf must be dispersed uniformly throughout the box and must not be allowed to form heaps or lumps, as such a state of affairs would prevent a uniform temperature being maintained and so result in fermentation proceeding more rapidly in certain parts of the bale than in others.

2. *Straight-laid Packing.*—This is the system which has been in force in this Colony since the establishment of the industry. It is fast giving way, however, to the more modern system of tonga packing. For the benefit of those persons who are still required to pack straight-laid, the following procedure is advocated.

The strings are cut to the length of the baling box and are placed lengthways in it with the butts of the leaves pointing outwards and the tips towards the centre of the box. As soon as the bottom layer has been completed, successive layers of strings are packed in similar fashion until the bale is of the requisite weight—approximately 80 to 90 lbs.

Loose leaf is packed in a similar fashion.

In both these systems of packing, care must be exercised in the application of pressure. If the bale is pressed down too tightly the leaf will be bruised and will tend to set in compact masses difficult to separate. On the other hand, if insufficient pressure has been applied, the leaf will tend to dry out too rapidly as a result of excessive aeration.

Once packing has been completed the bale should be allowed to set under pressure for several hours before it is sewn in good quality hessian.

The base, one end and the top of the bale are covered with the hessian, which is laced firmly in position by stout cord drawn from the top to the bottom of the bale along the three open sides.

The bale is then labelled according to grade and weight and is held in store until ready for shipment from the farm.

During storage the bales should be frequently examined to see that they are maintaining proper condition and are not drying out nor heating. The condition to be aimed at is good handling condition. In other words, the leaf should not crackle when handled nor should it feel soft and damp.

If the leaf shows a tendency to dry out, the humidity of the storage room should be increased or else the bale should be removed to a more moist atmosphere.

On the other hand, if there is any indication of the bale heating through the tobacco having been packed in high condition or through exposure to excessively humid conditions, the lacing should be slackened immediately and the bale be placed on end and the contents loosened so as to allow air to play through the leaf, particularly in the centre of the bale. After being sufficiently aired, the bale is again laced and stored away.

Just prior to despatch from the farm, the bale should be completely encased in D.W. Compo (a composite material consisting of baling paper and hessian), or in special quality baling paper superimposed by good quality hessian to protect the leaf from drying out and losing condition during the long journey.

The standard dimensions of a bale of Turkish tobacco are: length, 24 inches; width, 15 inches; depth, 18 inches. The standard weight of a bale is from 96 to 100 lbs. packed weight.

3. *Baling for Despatch to the Co-operative Company's Warehouse at Darwendale.*—After the tobacco has been cleaned and graded according to the standard required by the Turkish Tobacco Co-operative Company of Rhodesia, Limited, it is baled (in Virginia type baling boxes) on the strings in straight-laid fashion. The strings should not be cut, even if they are too long for the box, but the ends should be doubled over. Loose leaf is also packed straight-laid.

No mechanical press should be used during packing, the weight of a labourer being considered sufficient for the purpose. Bales should weigh about 75 lbs. and should be encased in D.W. Compo or in baling paper superimposed by good quality hessian.

Marketing.—Mention has already been made of the three systems of marketing open to the producer, viz. (a) by disposal direct to a manufacturer, (b) by disposal to a manufacturer through the medium of an agent or broker, and (c) by disposal through the Turkish Tobacco Co-operative Company of Rhodesia, Limited.

Seeing that the vast majority of growers in this Colony are members of the Co-operative Company, it is considered advisable to briefly describe the Company's system of operation as far as the handling and marketing of their crop is concerned.

As its name implies, the Company is a co-operative body whose members are producer-shareholders. The warehouse is situated at Darwendale — the main Turkish tobacco producing district of Southern Rhodesia.

Each member is required to clean, grade and bale his crop on the farm in the manner already described under the headings of " Handling and Grading of Cured Leaf " and " Baling."

Grading should commence as early in the season as possible so as to give the tobacco time to commence maturing in the bale before it is sent in September to the Company's warehouse for classification and further handling.

The member receives an initial payment on his crop based on the grades into which it is classified, and therefore it should be the aim of every grower to send his crop into the warehouse in good heart. Dryness and the presence of sand and dust naturally detract from the appearance of the leaf. Whereas a bale in too high condition will tend to heat and take on a musty smell through excessive fermentation setting in and the leaf will be completely destroyed if precautionary measures are not taken at an early stage.

Condition is best maintained by storing the bales not more than three deep in underground cellars. Each bale should be examined every few days and at the slightest inkling of the tobacco heating, it must be removed from the cellar and the bale in question be opened to allow air to play through the leaves, particularly in the centre of the bale. When dry the bale is again sewn up and stored in the cellar.

Every bale sent into the central warehouse is classified by two experienced members appointed by the Company. At the request of the Company, arrangements are made by the Department of Agriculture for a Government Tobacco Officer to be present at these classifications whenever possible. The duty of this official is to act as arbitrator in the event of the two classifiers not being able to arrive at a unanimous decision and to see that classification is carried out in accordance with the scheme agreed upon at the commencement of operations.

The bales are then stored in cellars according to their classification grades. As soon as facilities permit the tobacco is cleaned and graded, the leaf being removed from the strings. It is then stored in large bins according to its different grades. From these bins the leaves are passed over a mechanical shaker to remove any remaining sand, and are next packed " Tonga " fashion.

The bales are then transferred to a suitably constructed storage room where they receive expert attention while undergoing fermentation prior to being shipped for export.

Prospects.—In times such as these when the war is spreading from country to country, it is impossible to forecast with any degree of accuracy, the prospects of the industry. One can only base one's opinions on present-day demands and a comparison of present-day production figures with those of the past.

Table 1 shows the exports, by countries of destination, of Southern Rhodesian grown Turkish type tobacco. From these figures it will be seen that, over the period 1937 *to* 1941, *the*

United Kingdom was our most important market, followed by the Union of South Africa, the United States of America and Canada. In the case of the Union of South Africa, however, our exports have been markedly dwindling, so much so that, since the year 1939, *there has been no export of Turkish to that country, brought about by the Union Government declining to grant a duty-free quota to Rhodesia in an endeavour to further production in their own country.*

Canada and the United States have since taken the place previously held by the Union in our export trade. Exports to Argentine are now equal to quantities shipped to Belgium, Holland and other Continental countries before enemy occupation.

The relative importance of the United Kingdom and other markets to the Southern Rhodesian Turkish tobacco grower may be more conveniently appreciated when the exports are expressed in terms of percentages of the total exports from the Colony. This information is supplied in Table 2.

TABLE 1.

Exports of Southern Rhodesia Turkish Tobacco (Unmaunfactured) by Countries of Destination.

Destination.	Year Ending 31st December, 1937, lbs.	1938, lbs.	1939, lbs.	1940, lbs.	1941, lbs.
United Kingdom	255,435	461,372	508,715	463,537	178,554
Union of South Africa	138,615	194,008	—	—	—
Canada	—	8,646	—	48,658	141,593
Portuguese East Africa	—	1,520	4,636	1,035	—
United States of America	—	—	—	244,030	178,958
Argentine	13,036	4,961	—	—	67,690
Belgium	10,344	12,401	—	—	—
Holland	28,798	17,698	—	11,898	—
Other Countries	—	22,611	10,423	—	7,579
Total Exports	446,228	723,217	533,774	769,158	574,374

TABLE 2.

Figures in Table 1 Expressed as Percentages of Total Exports.

Destination.	Year Ending 31st December, 1937, %	1938, %	1939, %	1940, %	1941, %
United Kingdom	57.24	63.79	95.31	60.26	31.08
Union of South Africa	31.06	26.83	—	—	—
Canada	—	1.19	—	6.33	24.65
Portuguese East Africa	—	0.21	0.87	0.13	—
United States of America	—	—	—	31.72	31.14
Argentine	2.92	0.69	—	—	11.78
Belgium	2.32	1.71	—	—	—
Holland	6.45	2.45	—	1.54	—
Other Countries	—	3.12	1.95	—	1.32
Total Exports: lbs.	446,228	723,217	533,774	769,158	574,374

TABLE 3.

Production of Turkish Type Tobacco in Southern Rhodesia During 1940/41, Compared with Final Figures for Ten Previous Seasons.

Season	Acreage	Yield (lbs.)	Average Yield per Acre (lbs.)
1930-31 ...	828	375,464	453
1931-32	1,277	577,762	452
1932-33 .	971	393,356	405
1933-34 . .	1,425	694,204	488
1934-35 .. .	1,499	733,276	489
1935-36 ..	1,953	683,809	350
1936-37 . .	1,883	744,864	396
1937-38 . .	1,849	703,488	380
1938-39 .	1,767	575,900	326
1939-40	1,987	624,056	314
1940-41	2,449	1,067,801	436

The demand for Southern Rhodesian Turkish tobacco has shown considerable increase in recent years, and our produce is now well established on that market.

Buyers in the States are so pleased with the manner in which our Turkish tobacco is graded, handled and packed by the Co-operative Company at Darwandale, that they are desirous of taking a million pounds weight of our product and of increasing this quantity to three million pounds in three years. Naturally, of course, this demand is for specified grades. At present we are unable to meet it owing to shortage of production (See Table 3), and lack of markets for the consequent increase in poorer grades which neither the United States nor Canada nor the United Kingdom would touch.

It is well to bear in mind, however, the potentialities of these three markets, and it should be our firm resolve to more and more establish ourselves on them. This can only be done by producing good quality leaf, by handling the leaf properly, and by taking care that no tobacco is exported which has not been thoroughly cleaned, properly graded and properly packed.

The Minister of Agriculture and Lands (Captain the Hon F. E. Harris) speaking at the annual general meeting of the Rhodesia Tobacco Association on the 21st June, 1940, said that he thought Turkish tobacco had a big future in the Colony and that the growing of it should be encouraged.

All persons growing Turkish for the first time are advised to proceed in a small and experimental way by not growing more than five to ten acres until such time as they become familiar with the crop and have proved that their particular farms are suited to the production of this particular type of tobacco.

"The tobacco plant requires considerable attention and has an unpleasant way of retaliating when cheated out of it."

REFERENCES.

(1)Southern Rhodesia Department of Agriculture Bulletin No. 615: "Turkish Tobacco Culture in Southern Rhodesia" by D. D. Brown.

(2)*Rhodesia Agricultural Journal,* Vol. XXVIII, No. 8, August, 1931: "Tobacco Growing in Southern Rhodesia," by D. D. Brown. Page 710.

(3)*Rhodesia Agricultural Journal,* Vol. XXVIII, No. 8, August, 1931: "Tobacco Growing in Southern Rhodesia," by D. D. Brown. Page 712.

(4)Southern Rhodesia Department of Agriculture Bulletin No. 1054: "Alkalinity of Tobacco Seed-bed Soils," by A. P. Taylor, M.A., B.Sc.

(5)*Rhodesia Agricultural Journal,* Vol. XXVIII, No. 8, August, 1931: "Tobacco Growing in Southern Rhodesia," by D. D. Brown. Page 711.

(6)Southern Rhodesia Department of Agriculture Bulletin No. 715: "Turkish Tobacco Culture in Southern Rhodesia," by D. D. Brown.

(7)*Rhodesia Agricultural Journal,* Vol. XXV, No. 4, April, 1939: "Tobacco Eelworm (*Heterodera marioni*)," by J. C. Collins, B.Sc.

(8)Southern Rhodesia Department of Agriculture Bulletin No. 1026: "Notes on Tobacco Root-Knot Nematode," by J. C. Collins, B.Sc.

(9)"Industrial and Engineering Chemistry," February, 1940. Article by A. H. Cooper, C. D. Delamar and H. B. Smith.

A Description of the more common Rhodesian Wheat varieties.

By T. K. Sansom, B.Sc., Plant Breeder.

At the annual meeting of the Rhodesia Wheat Growers' Association on the 31st August, 1940, the formation of the "Rhodesia Seed Wheat Association" was approved.

The Seed Wheat Association will undoubtedly exercise a markedly beneficial effect on the wheat growing industry of the country. The chief object is the supply to farmers of sound and reliable seed wheat under the guarantee of the Association in respect to purity, trueness to variety, breed character and germination capacity.

With these objects in mind it is felt that a description of the more commonly grown varieties of wheat will be of help in the certification of seed.

Almost without exception all varieties of wheat grown in Southern Rhodesia at present belong to the common or bread wheats (Triticum vulgare). Although these wheats belong to the same species-vulgare—they shew a large number of varietal differences—these differences shew qualitative characters such as yield, disease resistance, milling quality of seed, etc. and morphological differences such as bearded or beardless, white or brown glume (chaff) colour red or white grains, etc.

In the wheat areas of Southern Rhodesia there is a fairly large variation with regard to soil and climatic conditions; some of the wheat lands are irrigated while others are on damp vleis from which the wheat plant has to rely on the moisture in the soil to bring it to maturity. The soil varies from fairly rich soil on some of the irrigated lands to the various types of vlei soil; the vleis vary from a greyish looking sand to an almost peaty looking soil; consequently the varieties are found to vary in response to the different conditions. However no amount of soil variation will change the morphological character of a variety such as beardedness or beardlessness, brown or white glume colour, red or white grains, etc., although they may be masked to a certain extent, especially with regard to colour of the seed.

As the varieties are often distinguished by names that are purely popular and often do not have any reference to distinguishable characters of the variety, some definite means of recognising varieties and distinguishing between them by observable morphological differences should be of assistance to farmers and others.

A description of the varieties to be of any practical use must fulfil two conditions:—

1. The criteria used in the description must be conveniently observable in the field and,
2. the criteria must be as constant as possible under varying environmental conditions.

The object of this paper is to give a description of the more commonly grown wheats in Rhodesia and it is hoped that this will form a nucleus around which eventually a good workable classification will be built.

Material and Methods.—The varieties described have all been grown at the Plant Breeding Station, Salisbury, both on vlei ground and on irrigated ground. The observations have extended over a number of years.

It was realised in the beginning that the wheat grown under field conditions was generally speaking mixed, and also there appeared to be a good deal of confusion as to the names of different varieties of wheat; in one instance one particular variety has three different names.

In undertaking this work care was taken first of all to secure material that represented the accepted variety type in each case; a pure line of each variety was then developed and used exclusively throughout. Seed was obtained from various sources in the Colony and elsewhere and was grown at the Plant Breeding Station, Salisbury.

The descriptions refer to well grown samples.

Characters used for Description:

1. Bearded or Beardless. This is a constant and hereditable character and very easily recognised. Between a completely bearded wheat i.e. a wheat in which all the flowering glumes bear awns and a completely beardless wheat in which there are no awns on any of the flowering glumes, there are some wheats which bear short tip awns; these wheats are included in the beardless division.

2. Hairyness or smoothness of glumes (chaff). This is also a constant and hereditable character. Only those wheats which are definitely hairy are classed under this heading. When only a few hairs are observed on the glumes they are classed as smooth.

3. Grain Colour: Varies from white, cream, yellow, brownish yellow, light red to deep dusky red. All yellows and creams are classed as white and only those kernels with a definite deep dusky or light red colour are classed as red.

4. Density of Ear. Ears may be dense, mid-dense or lax. A dense ear is one on which the spikelets are closely spaced on the rachis. A lax ear is one on which the spikelets are widely separated on the rachis and a mid-dense ear is intermediate between dense and lax.

5. Shape of Ear. Ears may be quadrate when the width across the face is equal to that across the two row profile or flattened when the face is greater than the two row profile or vice versa. Ears may be ovate when they taper at the apex or at both base and apex or they may be blunt or square at the apex or clavate when they are clubbed at the apex.

Description of Varieties: B.256.b1.A.64(L).

Description.—Head beardless, short tip awns, dense and fairly short, square; chaff smooth and yellow; face wider than 2 row profile; kernels medium size, long and fairly hard in texture, white; fairly early maturity; rust resistant, straw strong.

B. 286:

Description.—Head beardless, very short tip awns, mid-dense, fairly short, tapering; chaff smooth, yellow, with brownish tinge; face wider than two row profile. Kernels medium size, white (brownish yellow) round and fairly hard in texture; fairly early maturity, fairly rust resistant, straw strong.

Beltista:

Description.—Head bearded, lax, medium length, tapering; chaff smooth, brown with dark stripes or patches; face wider than two row profile; kernels large, white (brownish yellow), soft in texture with starchy appearance, early maturing, rust resistant, straw strong.

Droop 3:

Description.—Head beardless with short tip awns, lax, long, tapering; chaff smooth and light yellow, face wider than two row profile; kernels large, long, white (yellow) and fairly hard in texture; early maturing; fairly rust resistant; straw fairly weak, characteristic bend at neck.

Early Gluyas:

Description.—Head beardless with very short tip awns, mid-dense, medium length, slightly tapering to almost square; chaff smooth, brown, face wider than two row profile. Kernels large, white (yellow) and fairly hard in texture; early maturity; susceptible to rust; straw fairly weak.

Excelsior:

Description.—Head completely beardless, mid-dense, medium length and tapering; chaff hairy, yellow with brown tinge; face wider than two row profile; kernels fairly large, white (yellow) translucent, hard in texture, fairly early maturing, susceptible to rust, straw fairly strong.

58. F.L.1:

Description.—Head beardless, short tip awns, mid-dense, long, tapering; chaff smooth, deep brown; face about equal to two row profile; kernels medium size, long, red, fairly hard in texture, very late maturing; rust resistant; straw strong.

Granadero Klein:

Description.—Head bearded, lax, fairly long, tapering; chaff smooth, brown, face wider than two row profile; kernels fairly small, red, fairly hard in texture; very late maturing; very rust resistant; straw strong.

Jubilee. (Bred at Plant Breeding Station, Salisbury):

Description.—Head bearded, very strong black awns; dense, medium length, slightly tapering to square; chaff rough, light brown; face wider than two row profile; kernels fairly small, deep red, translucent, very hard in texture; early maturing, fairly rust resistant, straw very strong. An excellent milling wheat.

Karachi (White seeded type):

Description.—Head bearded, dense, medium length, slightly tapering; chaff smooth, deep brown, face about equal to two row profile; kernels small, white (light brown) with frequent small white starchy grains, very hard in texture, fairly late; maturing susceptible to rust, straw weak.

Karachi (Red seeded type):

Description.—Head beared, dense, slightly longer than white seeded Karachi, slightly tapering; chaff smooth, white; face wider than two row profile; kernels small, red, very hard in texture, slightly earlier maturity than white seeded Karachi, fairly rust resistant, straw fairly strong.

Selection made at Plant Breeding Station from Karachi ex-India.

Kenya Governor:

Description.—Head beardless, short tip awns, fairly lax, long, tapering; chaff smooth, deep brown, face about equal to two row profile; kernels medium size, white (brownish yellow) with characteristic pinkish tinge, fairly soft in texture; early maturity, fairly rust resistant, straw weak.

Kruger (bearded type):

Description.—Head bearded, lax, medium length, tapering; chaff smooth, white, extremely strong glumes with pronounced keel; face about equal to two row profile; kernels medium size white (yellow) hard in texture; early maturity; rust resistant; straw weak.

Kruger (beardless type):

Description.—Head beardless, short tip awns, lax, long, tapering; chaff smooth, white, extremely strong glumes with pronounced keel, face about equal to two row profile; kernels fairly large, white (yellow) fairly soft in texture; early maturing; rust resistant; straw weak.

Lalkasar Wali:

Description.—Head bearded, dense, medium length, slightly tapering; chaff smooth, deep brown; face about equal to two row profile; kernels slightly larger than Karachi, white (light brown) with very small percentage of white starchy grains as compared with fairly large percentage in Karachi; very hard in texture; fairly late maturing; susceptible to rust; straw weak.

Mentana:

Description.—Head bearded, dense, fairly long, very slightly tapering; chaff smooth, brown; face wider than two row profile; kernels medium size, white (light brown) dull appearance, fairly soft in texture; fairly early maturing; susceptible to rust; straw fairly strong. This wheat can be very easily identified before it is dead ripe when the swollen grain is visible between the outer and inner glumes.

N.B. 230 A.14(L):

Description.—Head beardless, short tip awns, mid-dense, medium length, tapering; chaff smooth, white, face wider than two row profile; kernels small, red, round, fairly hard in texture;

kernels of a poor sample are very starchy looking and soft in texture, fairly early maturity; rust resistant; straw weak.

131.C.5.P.:

Description.—Head bearded, mid-dense, medium length, slightly tapering; chaff smooth, white; face wider than two row profile; kernels white (light brown) medium size; hard in texture; very late maturity; very rust resistant; straw strong.

122.D.I.T.L.:

Description.—Head beardless, lax, very long, slightly tapering to almost square; chaff smooth, very pale brown, face wider than two row profile; kernels medium size, red, hard in texture, kernels of a poor sample, are very starchy looking and soft in texture; late maturing; rust resistant; straw strong.

Pilgrim:

Description.—Head bearded mid-dense, medium length, slightly tapering; chaff hairy, medium brown with black stripes; face wider than two row profile; kernels medium size white (light yellow) fairly hard in texture, fairly early maturing, rust resistant, straw fairly strong.

Pioneer (Bred at Plant Breeding Station, Salisbury):

Description.—Head bearded, very strong black awns, dense, medium length, slightly tapering to square; chaff rough, very light brown; face wider than two row profile; kernels fairly small, red, but have a more starchy appearance than Jubilee; fairly hard in texture; fairly early maturing, fairly rust resistant; straw very strong; slightly taller growing than Jubilee. An excellent milling wheat.

Punjab 8A.:

Description.—Head bearded, dense, medium length, slightly tapering; chaff rough, brown, has not got the deep brown sheen of Karachi; face about equal to two row profile; kernels fairly large, white, (light yellow) and very hard in texture; fairly late maturing; susceptible to rust, straw weak.

Pusa 4:

Description.—Head beardless, short tip awns, dense, short, slightly tapering; chaff smooth, very pale brown, face wider than two row profile; kernels large, white (light brown) hard in texture, very early maturing, fairly rust resistant; straw strong.

Quality (also known as Burbank or Florence):

Description.—Head beardless, very short tip awns, lax, medium length, slightly tapering: chaff smooth, very pale yellow to almost white; face wider than two row profile; kernels large, white (pale yellow) hard in texture and plump; early maturing, susceptible to rust; straw fairly strong. This wheat can be very easily distinguished in the field while still green by the bluish tinge of stems and leaves; shatters very easily.

Renown:

Description.—Head beardless, lax, long, narrow, slightly tapering; chaff smooth; white, face about equal to two row profile; kernels fairly small, red, fairly hard in texture, fairly early maturing, rust resistant, straw strong. This wheat can easily be distinguished by the purple appearance of the straw.

Reward (Selection from Canadian Reward):

Description.—Head beardless, very short tip awns which are dark in colour towards the base; chaff white with blackish markings before dead ripe, sparse covering of very fine hairs; face wider than two row profile; kernels medium size, dark red, very plump and hard in texture; early maturing, fairly rust resistant, straw very strong. This wheat excels in those characteristics which distinguish a wheat of high protein content and baking strength. It falls short in yielding ability, except where the land has had adequate manurial treatment when it will yield as well as the majority of wheats.

Rooi Else:

Description.—Head almost completely beardless, mid-dense, lax, medium length, slightly tapering; chaff smooth, pale yellow; face wider than two row profile; kernels fairly large, white (light brown) hard in texture; medium maturity; fairly rust resistant; straw fairly strong. The name Rooi Else is a misnomer as neither the chaff nor grains are red.

Sabanero (Selection made at Plant Breeding Station from Sabanero ex-Argentine):

Description.—Head bearded, mid-dense, long, slightly tapering; chaff smooth, deep brown, face slightly wider than two row profile; kernels medium size, red, fairly hard in texture; fairly late maturing; resistant to rust; straw strong.

Wit Else:

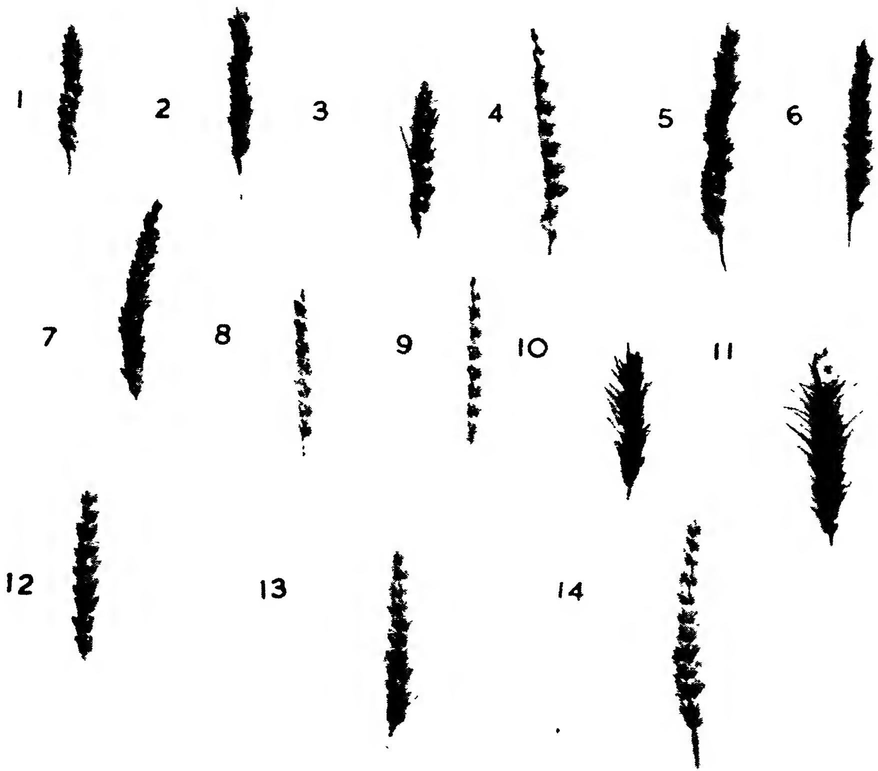
Description.—Head beardless with few very short tip awns, ear dense, short, slightly tapering; chaff smooth, very pale yellow; face wider than two row profile; kernels pale brown, medium size, long, fairly soft in texture; fairly early maturity; susceptible to rust; straw weak.

References:

1. Handbook of Canadian Spring Wheat varieties; Dominion of Canada. Publication 538. Farmers Bulletin 18.
2. The Wheat Plant: A monograph by John Percival.
3. Varieties of Wheat in New South Wales. J. T. Pridham, Department of Agriculture, New South Wales. Farmers' Bulletin No. 158.
4. A classification and detailed description of the more important wheats of Australia; Commonwealth of Australia, Institute of Science and Industry, Bulletin No. 26.
5. A classification of South Australian Wheat Varieties. H. C. Gurney, Journal of Agriculture, Department of Agriculture, South Australia, Bulletin No. 266.

ACKNOWLEDGEMENT.

The writer is indebted to the Chief Entomologist, Mr. J. K. Chorley, for permitting him to use the Camera in the Entomological Laboratories and for the taking and developing of the photographs. It is regretted that the photographs have had to be very much reduced in size owing to the necessity for conserving paper.


1
2
3
4
5
6
7
8
9
10
11
12
13
14

28

29

EXPLANATION OF PLATES.

PLATE I.

No. 1.—B.256. B.1. A.64(L).
No. 2.—B.286.
No. 3.—Beltista.
No. 4.—Droop 3.
No. 5.—Early Gluyas.
No. 6.—Excelsior.
No. 7.—Kenya Governor.
No. 8.—Kruger (Bearded).
No. 9.—Kruger (Beardless).
No. 10.—Lalkasar Wali.
No. 11.—Mentana.
No. 12.—N.B.230. A.14(L).
No. 13.—131 C.5. P.
No. 14.—122 D. I.T.L.

PLATE II.

No. 15.—Pilgrim.
No. 16.—Pioneer.
No. 17.—Punjab 8A.
No. 18.—Pusa 4.
No. 19.—58. F.L.I.
No. 20.—Granadero Klein.
No. 21.—Jubilee
No. 22.—Karachi (White Seeded Seln).
No. 23.—Karachi (Red Seeded Seln)
No. 24.—Quality.
No. 25.—Renown.
No. 26.—Reward
No. 27.—Rooi Else.

PLATE III.

No. 28.—Sabanero.
No. 29.—Wit Else.

GET BUSY ON MONDAY.

Cleanliness Aids Insect Control.

Stramonium.

FURTHER DETAILS REGARDING COLLECTING AND MARKETING OF THE LEAVES

By J. C. F. Hopkins, D.Sc. (Lond.), A.I.C.T.A., Senior Plant Pathologist.

Since the publication in the September/October issue of this Journal of the illustrated article on stramonium or stinkblaar, further arrangements have been made with regard to collecting and marketing, various suggestions having been put forward which will facilitate the gathering and export of the leaves. For instance, under certain circumstances, reaping of the whole plant might be an advantage. This method could suitably be employed by unsupervised natives on the farm, who could be sent out with a scotch cart to be filled with the whole plants whilst farmers would be able to sort out any wrong species which might be collected. The plants could then be hung up to dry and when in a suitable condition, stripped of leaves and flowering tops, which could be finally dried under cover. If unsupervised natives were to collect leaf singly, it is almost certain that an undesirable proportion of adulteration with wrong types would ensue. On the other hand, leaf by leaf collecting, under proper supervision, would ensure a high quality product and several reapings could be obtained in the season from the same plants.

With regard to drying, the essential thing to remember is that the leaves must be dried quickly. If necessary, they should be put out in the sun, the simplest method being to tie them by their stalks in bunches of about a dozen and suspend them along a light stick or reed. The sticks of leaves may be put out during the day time and, if necessary, brought under cover at night, although satisfactory drying has been obtained by placing them on the rafters of a lean-to iron roof.

Some uncertainty exists about the state of dryness to which the leaves should be reduced before being packed, because many people are afraid that damaged leaf is unacceptable. A good guide is to dry the leaf until the tip crumbles on being handled, when it will be found that the rest of the leaf, including stalk, has dried sufficiently to prevent mould developing and can be packed without too much crumbling taking place. The ideal method of drying would appear to be in a tobacco barn at a temperature of 105 degrees to 110 degrees F. In reasonably sunny weather, leaves dried under a roof are ready for packing in about 3 to 4 days. Drying in a barn should be quicker than this.

When dried, the leaves should be packed as tightly as possible in whatever container is available. If cardboard cartons can be obtained the leaf may be packed by placing a plank on the surface and using the weight of the body to press them down. It has been found that standing on the leaves directly causes an undesirable amount of breakage. Sacks can be used for consigning the leaf,

which should be pressed in as tightly as possible to increase the weight per bulk. The Farmers' Co-op., Ltd., Salisbury, have agreed to supply sacks to Women's Institutes on advice being received of the number required.

Packages may be sent carriage forward to the Farmers' Co-op., Ltd., Salisbury, who are handling the export of the product and may be consigned at rate 10, a concession which has been generously granted by the Railway Commission in view of the fact that the collection is part of the Women's Institutes war effort and not a commercial undertaking. Every care should be taken to keep the leaves dry. The suggestion has come from the Women's Institutes that any moneys accruing shall be applied to their funds to assist them in their war activities and this recommendation has been communicated to the Federation of Women's Institutes at their annual congress in Bulawayo.

It is recommended that all those interested in the collection of stramonium should commence gathering the leaves now and experiment with drying and packing so that when the growing season is at its height the best possible quality material may be prepared for export. It is requested, however, that the leaf be collected and stored by each Institute for the time being and not forwarded to the Farmers' Co-op. before December 15th, as special arrangements have to be made for handling the consignments.

The poisonous nature of the leaves and seeds must again be brought to the notice of those who propose to organise harvesting by children.

Modern Culling of Laying Hens.

By G. H. Cooper, Assistant Poultry Officer.

The operation of culling or the sorting of the profitable from the unprofitable amongst hens bred for egg production should be carried on all the year round.

Eggs.—Preliminary elimination of unprofitable birds commences in discarding unsuitable eggs for incubation. This operation is most important as it goes to the root of the existence of culls. For this reason there are some men devoting all their time and energies to the production of better stock; they are the stud breeders.

The commercial egg-farmer, therefore, will have this selection done for him if he purchases his stock from a reliable stud breeder, which practice is strongly recommended. If stock is not purchased annually in the form of day-old chickens then the commercial egg-farmer must go to considerable trouble and expense in selecting his breeding birds. The hens must be true to type and, more important from his point of view, have a record of at least 200 eggs in their pullet year of good standard size (2 oz.) quality, texture and shape. The male birds must, if possible, be even of better lineage than the hens from a production point of view and of robust vigour. As stated previously, the eggs from these selected pens must then be culled before incubation. Select only 2—2¼ oz. eggs of correct shape, good smooth texture and the correct colour, for the breed, e.g., all Leghorn eggs must be chalk white. Eggs for incubation should not be more than 7 days old in order to hatch sound, robust chickens artificially.

Chickens.—On hatching, culling commences immediately by refraining from assisting weak chickens from the shell; these will only be culled in a few months time after they have cost a few shillings more, so don't throw good money after bad.

Any deformed or weakling chickens should be killed when the hatch is taken off. Thereafter, during the whole growing period, any chickens not growing out well should be examined, and if the cause can only be laid at the door of poor constitutional ability then they should be disposed of to the best advantage, which may mean simply killing them off.

Pullets.—When the pullets commence laying the work of culling on actual production begins. The previous work done till now simply ensures that every pullet coming to maturity has the best chance the owner can give it of proving itself profitable.

Precocity.—Experiments [1] have shown that the best laying birds mature early and that the birds with the worst records usually commence to lay late in their pullet year. Therefore, the age of maturity, that is when the pullet comes into lay, is of great

(1) Rice (1915), Goodale (1918), Kennard (1921), Hays and Bennet (1923), Buster (1924), Jull (1924), Kempster (1925).

importance and helps in good culling practice. The quickness of feathering over the back is a guide to the precocity of pullets. Environment and management have a good deal to do with this rate of maturity, but even so the best birds will invariably mature first.

All pullets of the Mediterranean class should commence to lay in 200 days from hatching, and pullets of the dual-purpose class—most English and American breeds—should commence in 250 days if the rearing management has been on correct lines. Pullets taking longer than this to mature are usual more profitable if sold before they have eaten any more feed. On the other hand very precocious pullets are abnormal or badly managed and will more often than not be lacking in constitution and lay small eggs, so should be culled in most cases.

At this point culling practice may be continued by either (1) trapnesting or (2) individual examination of external characteristics.

(1) **Trapnesting.**—This method of determining the actual record of a bird was first made use of, as far as we know, by the late Douglas Tancred in the U.S.A.

The chief use of trapnesting is the selection of the best birds for pedigree breeding work, but to obtain the fullest use of them they should also be used on this type of poultry farm for culling the non-productive pullets. Any pullets not laying an average of 12 to 15 eggs per month during the first three months of laying will probably fail to score 150 eggs for the year, a number which is to-day reckoned the low limit for profit on the poultry farm where birds are fed on purchased feeds in semi-confinement. It will pay better to cull these pullets at the end of three months' trapnesting, also any persistently laying abnormal eggs of any description. During the remainder of the year all birds that show signs of failing to reach the 150 egg standard for any reason should be sold off.

At the end of the year only birds having laid 150 marketable eggs or over should be kept for the following laying season.

This system is of course excellent, providing a true record and enabling the owner to dispose of his culls the moment they become unprofitable and spreading the sales throughout the year. It is excellent for the poultry man near a good market where he can dispose of several dressed culls per week, for he will realise much more for them in this way than by selling a large number all at once as live birds. It is, however, a somewhat expensive system compared with the second method. (For construction of trapnests see Bulletins 870 and 875, obtainable from the Department of Agriculture, Salisbury.)

(2) The method of culling by means of the examination of the external characteristics of the hen was first used by the late Walter Hogan in the U.S.A. in 1905. The system is much the same to-day and is often still called "Hoganising."

In later years experiments have shown the correlation between the different physical characters and annual egg production; some have been found to have no correlation however. The characters chiefly held worth while studying to-day are:—

1. Pigmentation in yellow-skinned breeds and fat disposition.
2. Time of annual moult.
3. Capacity of abdomen.
4. Pliability of abdomen.
5. Width between pubic or pelvic bones.
6. Comb texture.

It will be noted that these are mainly physiological characters. The body measurements or morphological characters have shown less correlation with annual egg-production and, therefore, less emphasis should be placed upon them when using this method of culling.

(1) **Pigmentation.**—The yellow-skinned breeds possess a yellow pigmentation beneath the skin which is probably the most reliable single character for judging the past production of a hen.

Palmer (1915) has shown that the presence or absence of this pigment in the fowl or its eggs is directly correlated with the presence or absence in the feed of a carotinoid pigment called xanthophyl. It is clear, therefore, that hens fed on a ration of feeds devoid of this pigment may be pale and have the appearance of having laid, though actually they may not have produced an egg. The character of the feed being fed, therefore, should be considered when culling by pigmentation. Feeds such as yellow maize and all green feeds are rich in this yellow pigment. When a pullet commences to lay this pigment from the feed passes directly to the ovary and the developing yolk. Gradually the pigment stored in the body is drawn upon as production continues and does not return until the bird ceases to lay.—Blakeslee and Warner (1915), Palmer and Kempster (1919). The pigment disappears from the body in the following order as laying progresses:—

(i.) The vent loses its pigment rapidly so that a white or pink vent indicates laying and a yellow vent that the bird has ceased to produce.

(ii.) The eyering formed by the inner edges of the eyelids loses pigmentation a little more slowly than the vent.

(iii.) The earlobe is the next to bleach out, by which time the bird will have been in production for 2—3 weeks.

(iv.) The beak loses its pigmentation from the base first and the point last. The lower mandible bleaches more rapidly than the upper one. A completely bleached beak indicates 4—6 weeks continuous production.

(vi.) The shanks are the last to bleach because of slow circulation, commencing from the front and ending last of all at the back at the base of the hock. A bleached shank indicates continued production for about five months.

When a hen ceases to lay the pigment returns to the body in the same order in which it left. With a little thought, therefore, it is possible to tell fairly accurately the history of the last six months production of any yellow-skinned bird normally fed. For instance, pale shanks, yellow beak, yellow vent will indicate that

the bird laid more or less continuously for five months, but has ceased to lay for about one month. Pale shanks, pale vent, pale tip to beak with a yellow band around the beak, will indicate five months production, a break of non-productiveness of short duration occurring 2—3 weeks ago, whilst the bird is now in production again.

Fat Disposition.—The body fat varies in exactly the same way as the pigment in yellow-skinned breeds; in fact, the pigment accompanies the fat.

A high producer draws heavily on the body fat which passes in to egg yolks. Therefore the thin face, hollow flat shanks, tight plumage and the thin pelvics of the high producer are all due to the withdrawal of fat for egg production; whereas a fleshy face, full round shanks, loose plumage and thick fleshy pelvics denote that the body fat has not been used for egg production.

It is not that a hen cannot lay because she is fat, but that she is fat because she does not lay. (Newman, 1938).

A sickly or diseased hen may lack fat and pigment but must not be confused with the good producer.

Other characteristics such as bright eye, weight for the breed, appearance of plumage, capacity and activity will enable anyone to distinguish between such birds.

(2) Time of annual moult is the next to be considered when the main culling is done at the end of the first laying year when the bird has been in production for twelve months. In this respect due regard must be paid to the time of hatching, as it is found that late hatched pullets moult later than early hatched pullets. With this in mind, however, it has been shown that pullets moulting late in the season are better producers than pullets moulting early in the season. To make this clearer, a pullet hatched in July, if she moults in November the following year, will be a lower egg-producer than a pullet hatched at the same time that does not moult until the following March, provided always that outside influences are not concerned. Further, an early moulter usually takes longer to renew her feathers than the late moulter who moults quickly and is often in production again before the early moulter, thus she is out of production for a much shorter period. Blakeslee, Harris, Warner and Kirkpatrick (1917), Van Rooyen (1932).

(3) Capacity as indicated by the distance from the tip of one public bone to the posterior point of the keel is an indication of annual egg-production. Normally the greater the distance the better the egg-production. Van Rooyen (1932).

(4) Pliability of abdomen is judged by feeling the skin of the abdomen between the fingers. The heavy producer has been shown to have a velvety skin and the whole abdomen is soft and pliable, whereas the low producer has a thick, hard skin usually with a layer of hard fat beneath. Van Rooyen (1932).

(5) Width between pubic bones in the good layer is great whilst in the poor layer the bones may be almost touching. This measurement and also that of capacity varies according to whether the bird being handled is actually in lay at the time or not, and

due consideration must be allowed for this. The pubic bones themselves in the heavy layer are thin and tapering and pliable, whereas in the poor producer they are thick, blunt and stiff. Sherwood (1922), Van Rooyen (1932).

(6) Comb texture is gauged by the smoothness or otherwise of the surfaces of the comb. The high producer when in lay has a large full smooth waxy comb and wattles, whereas the poor producer's head appendages are smaller, rougher and coarser. Blakeslee, Harris, Warner and Kirkpatrick (1917), Van Rooyen (1932).

The correlation between these six characters and annual egg-production has been shown by investigators, but there are other minor characters which undoubtedly are also correlated in this way and are always found in the good producer—they may be summarised as follows:—

A bright prominent round eye, sound in colour; free from feathering round the face; tightness of feathering; the face clean cut and rather thin; strong short well arched beak; the temperament is active, nervous and alert, yet the bird is friendly and easily handled, especially if trapnested; appetite seldom satisfied. A broad back and deep body are also desirable, though not essential, for the great layer.

General activity and vigour, of course, play a great part in the make up of the high producer. It must be clearly understood that when handling birds for culling using these principles due regard must be paid to age and breed of birds. Also, it is essential that the operator should take into consideration all the characters as set forth and not cull a bird for failing in one or two respects. Judgment is required. Practice is essential before anyone can become really efficient, though it comes very easily. It is the duty of every poultryman to understand this work to the best of his ability, for to obtain the best results from his flock he must perform the operation himself when production indicates. He knows best how the birds have been managed and, therefore, is in the best position to cull them.

This main culling by means of examination of the external characters as enumerated should be carried out in mid-December in order to get as many birds sold during the time when high prices are ruling and when early moulters have stopped laying. A later culling may take place in February or March, when the best birds are being selected for breeding purposes.

The best method of handling the birds is to drive them, a few at a time, from the laying house through a trap door into a catching crate. From the crate they are culled and placed in their respective pens. By this means the birds are not frightened and the operator can be working the whole time. A catching crate has sliding doors at each end and a hinged door on top for the removal of birds.

To cull, a right-handed person should grasp a bird in the crate by a wing close to the body, remove it carefully and then grasp the legs immediately above the hocks in the left hand between thumb and fingers, having the head towards the operator and the breast of the bird lying flat along the palm of the hand.

In this attitude the bird may be turned in any position for examination and handled easily and correctly with the right hand.

If a flock of pullets is culled at the end of the first laying year, the remaining birds should pay to keep for the next year. At the end of the second laying season only those birds good enough to be classed as breeders should be kept for a further season, for production is highest during the first season and normally drops every succeeding year.

REFERENCES.

(1) Blakeslee, A. F., and Warner. D. E., 1915.—"Correlation between egg-laying and yellow pigment in the domestic fowl." An. Nat. 49:360-368.

(2) Blakeslee, A. F., Harris, J. A., Warner, D. E., and Kirkpatrick, W. F., 1917.—"Pigmentation and other criteria for the selection of laying hens." Storro Agr. Exp. Sta. Bul. 92:95-194.

(3) Buster, M. W., 1924.—"Rate of maturity as an indication of future egg production and profitableness in a single comb White Leghorn pullet in commercial flocks." Poultry Sci. 3:194-200.

(4) Goodale, H. D., 1918.—"Inheritance of winter production." Science N.S. 47:542-543.

(5) Hays, F. A., and Bennett, J. S., 1923.—"The correlation of sexual maturity to annual production." Poultry Sci. 2:205-206.

(6) Jull, M. A., 1924.—"Egg weight in relation to production. II. The nature and causes of changes in egg weight in relation to annual production in pullets." Poultry Sci. 3:155-172.

(7) Kempster, H. L., 1925.—"The correlation between maturity and egg production." Missouri. Agr. Exp. Sta. Res. Bul. 78:3-15.

(8) Kennard, D. C.—"Early maturity versus late maturity White Leghorn Pullets." Ohio Agr. Exp. Sta. Monthly Bul. 6:163-167.

(9) Palmer, L. S., 1915.—"Xanthophyl, the principal natural yellow pigment of the egg yolk, body fat and blood serum of the hen." Jour. Biol. Chem. 23:261-277.

(10) Palmer, L. S., and Kempster, H. L., 1919.—"The influence of specific feeds and certain pigments on the colour of the egg yolk and body fat of fowls." Jour. Biol. Chem. 39:331-337.

(11) Rice, J. E., 1915. "The distribution of egg production." Cornell Countryman 12:5-8.

(12) Sherwood, R. M., 1922.—"Correlation between external body characters and annual egg production in White Leghorn fowls." Texas Agr. Exp. Sta. Bul. 295:3-14.

(13) Van Rooyen, L. A., 1932.—"The relation between external body characters and annual egg production." Union S.A. Dept. Agr. Bul. 110.

(14) Newman, T., 1938.—"Principles and Practice of Poultry Husbandry." English Universities Press.

New Machines for Britain's Harvest.

MECHANISATION AND THE FOOD PRODUCTION DRIVE.

By H. Isaacs, Machinery Officer to the Surrey War Agricultural Executive Committee.

Issued by Industrial Publicity Unit, Mowbray House, London.

Millions of acres of ploughed-up grassland in Britain have created an unprecedented demand for new and improved types of farm machinery. Used not only by individual farmers but by the County War Agricultural Committees through which the Government directs the agricultural war effort. Most of these machines are new to British farms and many to agricultural practice generally.

Grinding Ear Corn.—One machine which promises to be popular is the hammermill which effectively grinds oats, barley, ear corn, beans, peas, hay and other fodder. Practically any degree of fineness can be obtained, and four tons of properly ground feed will produce as much meat as five tons of unground feed. Moreover, the grinding of certain roughages renders them more digestible and eliminates waste.

The hammermill, which is of steel and can be driven by a belt off most makes of tractors, consists of a metal tray or hopper through which material is fed into a drum wherein revolves, at very high speed, a rotor supported by a sturdily built shaft. On the rotor are fitted hammers, pieces of steel 4 inches wide and approximately ¼ inch thick. These hammers vary in length and there are four to each section, in the form of a cross, each section being kept apart by spacers. Their tips are of specially hardened steel.

The bottom of the drum is formed by a semi-circular screen, which is reversible and is obtainable in a variety of sizes to enable corn and straw, or both, to be ground to the degree of fineness required.

The hammers revolve at a set distance from the screen and the material is hammered until fine enough to be drawn through by a large fan, which then forces it up through a pipe for bagging.

Ready-made Thatch.—Another of the new machines is the "spider" thatchmaker, an invention patented in 1896, but still-born because it was before its time. Now produced in a modernised power-driven version, it enables ricks to be covered at half the cost and one-fifth the man-hours of the old method. It is being made in hundreds for Britain's next harvest. The thatchmaker consists of a framework supporting a table upon

which straw is fed by hand to conveyors, which force it between upper and lower plates. Ordinary binder twine is fed by tension rollers to two needles which are driven up and down through the two plates. As the straw is fed through these plates the two needles pierce it at regular intervals and the twine is knotted by two curved steel fingers which pick the loops from the needles and slip the previous loop.

No particular skill is needed to operate the "Spider," although care must be taken to use good fairly straight straw and to feed it evenly without gaps. The mats of straw so made can be laid directly on the stacks and fixed either by pegs or thatching needles. They can also be put through the machine a second time so that the straw is bound in four places, when they make excellent lambing pens.

One of the great advantages of this machine, especially where labour is difficult to get, is that thatch can be made before the stacks are built, in the winter or during wet spells.

Straw Bailers.—Much greater quantities of straw are being produced as the result of the ploughing-up campaign, and this has led to a demand for handy sized balers. A small model known as the Mitchell Press is proving very popular, for it can be easily and quickly transported, together with its engine unit, from one site to another. The bales are bound with wire and in the writer's part of the country it is operated comfortably by five Land Girls.

Pick-up balers are also being used, either for hay-making in the fields or as stationary units. They are generally driven by a power take- off, consisting of the usual type of baler fed by an endless belt fitted with spikes which pick the hay from the ground as the whole machine is being pulled along.

Combine harvesters are coming into increasing use, and many Australian and American makes can be seen on British farms.

Draining Machines.—One of the greatest problems in the drive for greater food production at home has been the need for draining water-logged land. There is a new ditching machine, which, while it does not replace the well-known excavators, proves quite sufficient for general work. Operated by a small track-laying tractor and mounted on skids, the machine consists of a framework supporting a side drag arm fitted with a bucket scoop. The latter are aligned in the ditch and the machine is pulled by the tractor until the scoop is full, when a trip is released and the tractor, continuing on its journey, hauls a steel girder from its casing. This girder operates a tipping device by pulling the bucket up and out of the ditch by means of a cable. The drag arm, which is pivoted in the front of the machine, is also pulled up and towards the machine, half turned, and the bucket is struck sharply on the framework, thus dislodging the spoil behind the machine. The tractor then reverses and, as the girder slips back through the casing, the drag arm and scoop is returned to the ditch.

This machine is simply constructed and is inexpensive but, like all machines, requires a little practice in its use before efficiency is attained. Steering is given by a flanged wheel at the rear, which bites into the earth at an angle determined by the operator using the steering wheel.

Rotary Cultivator.—Another machine proving popular in some parts of Britain is the rotary cultivator, which consists of a two-wheeled framework on which is mounted a shaft fitted at intervals in the form of staggered crosses with curved tines or knives. The shaft, which is driven by a power take-off, revolves at a determined speed in the ground at a depth which can be varied, this action breaking the soil into a fine tilth and bringing weed roots to the top.

The principle is, apparently, that the earth, being heavier, drops first while the lighter roots fall on top of it. The set of the tines also plays an important part in dragging the roots to the top.

Clearing Banks.—The familiar bull-dozer, of road-making fame, is now making its appearance on Britain's farms, and is busy clearing banks and turning small fields into large ones, with much saving in cultivation costs and labour. It is a large, rectangular, curved, steel plate fitted horizontally to the front of a track laying tractor and is lifted hydraulically. The tractor forces this plate against banks and pushes the earth away. This is then gradually levelled off on the surrounding land by allowing it to escape beneath the plate.

Automatic Potato Planting.—Many types of potato planters are also in use, one type, known as the P.G.M., consisting of three very large wheels fitted with slots into which the seed is dropped by operators seated at the rear of the machine. The seed is then carried forward and down and deposited in the ridges, which are closed by means of ridging bodies fixed at the rear of the wheels. Another type of machine, known as the Albion, sows seed by means of an endless belt fitted with plates which travels in front of the operator who drops seed into the compartments. The belt then travels down, supporting the seed on the plates, and drops them in the furrow or groove made by a shoe which rides in the front.

Manure is also sown by means of a belt travelling across the bottom of the fertiliser container, and is so arranged as to deposit the fertiliser in the same groove as the seed. The fertiliser is regulated by a slide in the slot through which the belt carries the fertiliser to the furrow. The seed and fertiliser is then covered in by means of two discs set at angles at the rear of the machine.

The writer has used this machine in sowing potatoes and fertiliser in ridges already prepared, and a very satisfactory job has been made.

Another machine, known as the Iron Age potato planter, performs the same work as the Albion, but the potatoes are deposited in the groove by means of picker arms fitted with slender sharp steel picks. These arms travel through the seed container and, by means of the steel picks, the seed is withdrawn and fed through a spout into the furrow. The seed is released from the picks by means of a cam which withdraws the pick from the seed. The machine can also be fitted with a fertiliser distributor which is regulated in a similar manner to the Albion.

The operator of this machine does not feed it, but merely ascertains that each pick is loaded with seed, the seed being

sorted from the box by means of slotted wheels. Although the writer has not used this machine it would appear to go a long way towards preventing seed being missed, and should ensure regular sowing.

Two Hundred Cabbages a Minute.—The increase in cabbage planting has made farmers more familiar with a machine which has been on the market for some time, known as the Robot transplanter. Four operators are seated around a tray of cabbage plants, which are picked up by the operators and placed into rubber clips conveyed by means of a belt around the top of the machine, and carried down and deposited vertically in a furrow made by a forward shoe. The furrow is closed by means of two wheels set at angles which press the sides of the furrow.

This machine, which sets out 200 plants a minute can, by altering the clips, be adapted for sowing potato seed, and has recently been fitted with a water tank, so that plants can be planted in all sorts of weather during the proper season.

The implements described are as follows:-

Hammermill.- Made by Sale, Tilney & Co., Winnersh.

P G.M Potato Planter.- Made by Sale, Tilney & Co., Winnersh.

Iron Age Potato Planter.--Made by Tilney & Co., Winnersh.

Albion Potato Planter.—Made by Harrison, MacGregor & Co., Ltd., Leigh, Lancs

"Spider" Thatchmaker. Made by Harvest Saver & Implement Co., Ltd., London, W.1.

Mitchell Press.--Made by Deming & Co., Chard, Somerset.

Ditching Machine. -Made by Bomford & Evershed, Salford Priors, Evesham.

Rotary Cultivator. -Made by Fishleigh Rotary Cultivator Co., Ltd., Barnstaple.

Robot Cabbage Transplanter. Made by Transplanters (Robot) Ltd., St Albans, Herts.

The Farm Home

Recipes.

The following recipes, sent by a reader of the Journal, should be most welcome at present, when butter is rationed. They have been specially chosen as they require little or no butter.

Suet Paste.—1 lb. flour, pinch salt, 6 oz. beef suet, ½ pint cold water. Free the suet from all skin and shreds and chop very finely. Put flour to salt in basin and rub suet well into it. Mix into smooth dough with ½ pint cold water, then roll out and use.

Roly-Poly Pudding.—1 lb. suet paste, jam or treacle. Roll out paste ¼ inch thick, spread even with jam or treacle to within an inch of edge; wet the paste and press it firmly together at the ends; wring a cloth out of hot water and flour well. Place pudding in centre and tie ends, tightly pin it in centre. Boil for 1½ hours. Remove cloth carefully. Pour over a nice sweet sauce and sprinkle top with sugar.

Christmas Pudding.—3 ozs. flour, 3 ozs. bread crumbs, 6 ozs. stoned raisins, 6 ozs. currants, 4 ozs. minced apple (or carrot), 5 ozs. sugar, 3 eggs, 6 ozs. suet, 2 ozs. peel, 1 teaspoon spice, 1 small wine glass brandy, pinch salt, little nutmeg, pinch mace (pounded). Mix the ingredients together, beat well. Put in basin tied in cloth. Boil for 4 hours keeping the pudding well covered with boiling water. Then turn out, sift icing sugar thickly over top. Pour 3 tablespoons brandy round and set alight before sending to table.

Coffee Sponge.—1 tablespoon gelatine, 2 egg whites, pinch salt, 2 tablespoons cold water, ¾ cup castor sugar, 3 cupfulls strong hot coffee, ½ teaspoon vanilla essence. Cover gelatine with cold water for 10 minutes, then add sugar and pour the hot coffee over, stirring until gelatine dissolved. Cool, add vanilla and when about to set add the egg whites beaten to a stiff froth. Beat until spongy and light. Turn into a mould to set. Serve vanilla or lemon custard.

Green Mealie Stuffing.—1 cup cooked green mealies, 1 cup bread crumbs, 1 tablespoon melted butter or **dripping**, 1 teaspoon chopped parsley, seasoning, 1 egg. Mix all the ingredients well together with beaten egg and use for stuffing poultry.

Steamed Gingerbread.—½ lb. flour, 2 ozs. lard, 2 ozs. sugar, 2 ozs. treacle or syrup, 1 teaspoon ground ginger, 1 teaspoon cinnamon, ½ teaspoon salt, ½ teaspoon bicarbonate soda. Beat in one whole egg. Mix all together. Steam in tin or bowl for 2½ hours.

Tablet.—1 lb. sugar, 1 oz. butter, 2 ozs. syrup, ½ teacup milk. Melt all together **slowly**, boil 20 minutes, beat, pour out, score before cold.

REMEDIES FOR STAINS

The following remedies for stains have been received from a correspondent, and should be very helpful to us all in our savings campaign.

Cocoa Stains.—Apply a solution of borax in boiling water. If soap is applied previously, it renders the removal of the stain more difficult.

Coffee Stains.—These can be removed by the above method, if it is carried out immediately. A little glycerine rubbed in and washed out with warm water should be effective if the stains are only a few hours old. Boiling water applied immediately will remove black coffee stains.

Tea Stains.—Treat these in the same way as coffee and cocoa stains, but apply glycerine as a solvent before washing if the stains are greasy owing to cream.

Ink Stains.—Dip the stained part in a piece of melted tallow, or immerse immediately in milk. Allow to soak for 12 hours and then wash thoroughly. Another very good remedy, that should be restricted to stains on white materials or those with very fast colours, is salt and lemon. Sprinkle the stain thoroughly with lemon, and pile salt on top. Dry it in the sun. When dry apply more salt and lemon, and repeat once or twice. After several hours, wash, rubbing very thoroughly, with soap and water. With perseverance every mark should disappear.

Wine Stains.—Dab the stain with boiling milk. If this should not prove effective after washing in soap and water, try an application of salt and a few drops of lemon juice.

Grease Stains.—Rub a lump of magnesia on the grease spot, or place a piece of brown paper over the spot and another piece underneath it and apply a hot iron.

Grass Stains.- On flannels, rub the stain with glycerine and leave on for an hour or so. A lather of soap and warm water should then be applied. Methylated spirit dabbed on with a clean cloth is the treatment for fabrics which cannot be laundered. If the material can be washed, soak the stained part in cold water, then leave in the sun after covering the stain with a little cream of tartar.

Ironmould Stains.—Squeeze a few drops of lemon juice on to the stain after previously covering it with salt, then rinse in a weak solution of ammonia and water, and finally rinse in cold water.

Fruit Stains.—If immediate treatment is possible, spread the material over a basin and pour on boiling water. If this is not successful, dip the fabric in a weak solution of ammonia and water.

Something About Hides.

By "Ex Tanner."

The normal destination of a hide is a boot factory and therefore the requirements of the boot manufacturer have a predominant effect upon the classification and grading of hides throughout the world's markets.

The hair or "grain" side of the hide is more important than the flesh side, because this is the side that is seen in the finished article, whether as soles or upper leather. The boot manufacturer has to avoid all damaged parts of the leather when cutting out, such damage being caused by brands, cuts, goring and scratch marks, rubbed patches and insects. In cutting around these places there is wastage and, therefore, a hide containing one or two such faults is of less value to him than a perfect piece of leather, and he pays less. This in turn affects the tanner, who thereupon demands equivalent grading in the raw hide. (Note that a brand in the **neck** is overlooked and will not degrade a hide.)

Putrefaction (taint) has not been mentioned among the above faults as it is in a class by itself. Taint is the worst thing that can befall a hide; its first manifestation being loosening or "slipping" of the hair. It takes very little taint to make the hide valueless, for what can be seen on the surface is as nothing compared to the damage underneath. A hide so affected falls to pieces in the tannery, and about its only use is in making glue. In this climate putrefaction sets in very rapidly, and the hide should be cured the same day as the animal is flayed.

The curing of hides falls into three categories:—

(a) Shade-drying on frames.

(b) Salting, wet or dry.

(c) Sun-dried.

The first method is the most suitable for this climate, it being more easy to obtain first class results, apart from the fact that the cash return is better. Briefly the method is to suspend the hide inside a frame by tambo, so that the hide has at least a foot of air all round it; the frame is put in the shade vertically during drying. Where several hides are being handled it is perhaps more convenient to build a thatched drying shed, open on all sides to the air and wind.

Salting hides sounds rather more easy than it actually is, particularly when only a few are being handled. The hide is spread flesh side upwards and about 15 to 20 lbs. of salt thoroughly rubbed in all over the surface, but unless the hide can be kept wet for several days first it is apt to dry out half salted.

Sun-dried covers all other methods, whether it be by drying the hides in the sun, on the ground in the shade, pegged out, hanging over poles, etc. The hides from these processes are unreliable, having serious latent defects, and so the tanner pays a lower price.

In both shade- and sun-dried cure the hides should be thoroughly treated with weak cattle dip to prevent the inroads of insects.

Hides are sold by weight and grade, and the ceiling price has been fixed by the Allied Governments at a moderate level.

A growing number of farmers and ranchers appreciate the need for care in handling hides and now get top prices consistently, but there are still many who send in low quality or valueless hides, and this is a loss both to themselves and to Rhodesia.

Tick Transmission of Disease.

By D. A. LAWRENCE, B.V.Sc., Director of Veterinary Research.

Ticks may be harmful to an animal merely as a direct result of the amount of blood they remove in feeding, the irritation they cause, and the injury they inflict on the skin, thus interfering with its normal functions and furnishing openings for the invasion of organisms, such as bacteria or fly larvae (screw worms), that normally cannot invade the intact healthy skin. These harmful effects of tick-infestation may in themselves be very serious, but even far more serious is the fact that ticks transmit deadly diseases. It is the latter aspect that is of prime importance to the veterinarian and the cattle-owner.

Transmission of Disease.—Ticks do not directly cause disease —they transmit the infection and therefore must themselves first acquire such infection before being capable of transmitting it to an animal. One may thus have ticks of a species known to be the transmitter of a particular disease not themselves carrying infection and therefore capable of feeding on an animal without producing disease in it; for example, the Bont tick is the proved transmitter of Heart Water, but every Bont tick has not acquired a Heart Water infection, i.e., it is not infective and therefore only those Bont ticks which have become infected are capable of setting up the disease, the others may feed on a beast without causing anything more than the directly harmful results first mentioned.

How do Ticks become Infective?—Some knowledge of the life cycle of ticks is essential before the answer to this question can be appreciated. For the purpose of this note only ticks of the family Ixodidae will be considered, as the members of the Argasidae family are intermittent feeders and are generally not important except in the transmission of the diseases of poultry and man.

There are four distinct stages in the life of a tick, viz., the egg, the larva (or seed tick), the nympha (intermediate stage) and the adult (mature stage).

When an adult female has fed to repletion (become engorged) on an animal it loosens its hold and drops to the ground; it then crawls into some little sheltered nook or cranny and thereafter lays its batch of eggs, which vary in number from a few thousand up to 18,000, depending on the species. As laying progresses so the tick gradually shrivels up and eventually dies.

After a variable lapse of time, a few weeks to several months depending on the surrounding temperature, the eggs hatch giving rise to the minute larval (seed) ticks. These crawl up on to the grass or bush and wait until they are brushed off by some passing animal. Having thus reached their host they crawl about until they find a suitable spot at which to bite in with their mouth-parts and there become attached and feed. They remain feeding

at this site of attachment until replete, i.e., they have now become fully engorged larvae. They are still extremely small, and will not feed again until they have undergone a moult to become nymphae. From this stage (engorged larvae) different species of ticks behave in different ways—some undergo their first moulting on the animal on which they have been feeding, e.g., the Red (or Red-legged) tick and the Blue tick, whereas others become detached, drop to the ground and undergo their moult there, e.g., the Brown. Bont-leg and the Bont ticks.

In the nymphal stage the procedure is repeated, i.e., the still extremely small unfed nympha gets on to an animal (unless, as in the case cited in connection with the Blue and Red-leg ticks, it had undergone its moult on one), attaches and feeds to repletion, thus becoming a fully engorged nympha. At this stage it is somewhat smaller than a small match-head. Just as in the case of the engorged larva, the engorged nympha also will not feed again until it has moulted into an adult. With the exception of the Blue ticks, which undergo even their second moult on the original host, the engorged nymphae become detached, drop to the ground and there moult to become adults.

In the adult stage the sexes are differentiated. Both males and females on first emerging from the nymphal moult are fairly small and flat. These adults also have to get on to animal (except in the case of the Blue tick which is already there) and then become attached and feed to repletion. Whereas the males remain much the same size as when unfed the females become more and more enlarged as feeding progresses until finally they are tremendously distended. During the period the female is feeding, or rarely even before she is attached, copulation occurs, the smaller male being found on the underside and towards the head-end of the female. When the female has fed to repletion and become fully engorged she becomes detached, drops off and proceeds to lay her eggs, thus completing the life cycle. The males may also drop off, but it is not unusual for them to remain attached for a considerably longer period on the same host.

Thus is may be seen that we have three main classes of these ticks, the one-host tick (Blue tick) which remains on the same animal from the time it first gets on as an unfed larva until it drops off as an engorged adult; the two-host tick (Red tick) which passes its larval and nymphal stage on the same host and then drops off to moult into an adult, which then must again find a host on which to feed: and finally the three-host tick (Brown, Bont-leg, Bont ticks) which feeds as a larva on one host, drops off, feeds as a nympha on its next host, drops off and feeds finally as an adult on a third host.

In the case of the one-host tick, therefore, it is obvious that it cannot both acquire infection from one beast and give it off to another in the same generation. What actually happens is that infection may be picked up during the larval, nymphal or adult stage from the particular beast on which these stages have been spent, and then passed on through the eggs to the next generation to be given off to the next beast by the larvae or nymphae or adults. The Blue tick is a known transmitter of

Redwater and actually gives off its infection in the larval stage, though it is possible for the infection to persist even to the third generation, that is through two egg stages.

In the case of the two-host ticks infection may be picked up in either the larval or nymphal stage from the particular beast on which these are spent and then given off in the adult stage to the next host, or alternatively picked up in the adult stage and passed on through the egg into the next generation.

Finally with the three-host tick the possibilities are that infection may be picked up in any stage from one beast and given off in the following stage to the next host, including the possibility of an adult acquiring infection and passing it on through the egg to the next generation.

The above illustrates the various possibilities of how infection may be picked up and given off by the various main groups of ticks. The actual method of transmission of different diseases by different ticks has in many instances been accurately worked out and is diagramatically illustrated below in connection with the commoner disease and transmitters. An essential feature to be remembered is that a tick will not pick up and give off infection in the same stage of its development for the simple reason that it must complete that particular stage on one host—if, for example, an adult tick is feeding on a sick beast it is useless to detach it with the object of getting it to attach again, feed on and transmit infection to a test animal. The general rule is that when once a tick has become attached and commenced to feed, no matter what stage it is in, it will not, if removed and placed on another beast, again attach and feed.

From the table, therefore, it is quite obvious that to elucidate the exact manner in which any given disease is transmitted by ticks involves a considerable amount of work.

Where the disease can be produced by means other than ticks, e.g., by direct inoculation of blood from a sick to a healthy animal, the investigations are greatly simplified. For example, if one were trying to find out whether and how ticks transmit Redwater, one could easily reproduce the disease by inoculation and feed various stages of different species of ticks on it while it was reacting, and then feed these ticks later in their different stages on a susceptible beast and so determine which species was the transmitter and at which stages of its life cycle it picked up and gave off infection.

There are some tick transmitted diseases, however, that normally cannot be established by inoculation, e.g., East Coast Fever, and the problem in such cases is far more difficult as it makes one entirely dependant on naturally contracted cases of the disease for the purpose of preliminary investigations of the method of transmission. It will be appreciated that in such cases a considerable time might elapse before the problem can be solved. more especially when the course of the disease being investigated is short, i.e., the time that elapses between the first appearance of symptoms and occurrence of death or recovery.

In this Colony there is at least one tick-transmitted disease of cattle, a form of Theileriosis, in which the actual method of

TRANSMISSION METHODS.

Disease.	Cause.	Tick.	No. of Hosts.	Larva	Nympha	Adult	Egg	Larva	Nympha	Adult	Egg	Larva
Redwater (Piroplasmosis)	Babesia bigemina	Palpoboophilus decoloratus (Blue tick)	One	x	x	x		→				
				x	x	x						→
		Rhipicephalus appendiculatus (Brown tick)	Three		x	→						
						x		→				
		Rhiphicephalus evertsi (Red-leg tick)	Two	x	x	→						
						x		→				
Gallsickness (Anaplasmosis)	Anaplasma marginale	Palpoboophilus decoloratus (Blue tick)	One	x	x	x		→				
		Rhipicephalus simus (Black-pitted tick)	Three			x		→				
East Coast Fever (Theileriosis)	Theileria parva	Rhipicephalus appendiculatus (Brown tick), Rhipicephalus simus (Black-pitted tick), Rhipicephalus capensis (Cape brown tick)	Three	x	→							
					x	→						
		Rhipicephalus evertsi (Red-leg tick)	Two	x	x	→						
Heartwater (Rickettsiosis)	Rickettsia ruminantium	Amblyomma hebraeum (Bont tick)	Three	x	→							
					x	→						
				x	. . .	→						
Mild Gallsickness (Theileriosis)	Theileria mutans	Rhipicephalus appendiculatus (Brown tick)	Three		x	→						
		Rhipicephalus evertsi (Red-leg tick)	Two	x	x	→						
Spirochaetosis of Cattle	Spirochaeta theileri	Palpoboophilus decoloratus (Blue tick)	One	x	x	x		→				
		Rhipicephalus evertsi (Red-leg tick)	Two	x	x	→						
						x		→				
Biliary Fever of Horses	Nuttallia equi	Rhipicephalus evertsi (Red-leg tick)	Two	x	x	→						
	Babesia caballi	Dermacentor reticulatus	Three		(Same	tick)						
				x	→	→						
						x				→		
Biliary Fever of Dogs	Babesia canis	Haemaphysalis leachi (Dog tick)	Three			x				→		
		Rhipicephalus sanguineus (Brown dog tick)	Three		x	→						
						x			→			
						x				→		
		Dermacentor (reticulatus and venustus)	Three			x				→		

transmission has so far not been determined. There is no doubt that when the right set of conditions arise rapid progress in clearing up certain points which are at present obscure will be made. In the meantime, however, in spite of the absence of an exact knowledge of transmission the important fact that this disease has been proved to be tick-transmitted does enable control measures to be adopted. These, as in the case of all tick-transmitted diseases, are based on the knowledge of the life cycle of ticks and consist of conscientious dipping and where necessary hand dressing.

EXPLANATION OF SYMBOLS.

× =Stage at which infection is picked up by the tick when feeding on an infected animal.

→ =Stage at which infection is given off when feeding on a a susceptible animal.

. . . =The dotted line in the case of the Blue tick transmitting Redwater and the Bont tick transmitting Heartwater indicates that if the infected tick feeds on a non-susceptible host infection is retained over the stage or stages shown and then given off subsequently when a susceptible host is fed upon.

NOTE.—It should be noted that although infection may be picked up in a particular stage it is not necessarily given off in the immediately following stage, and also that infection may not be picked up at every stage; for example, one might expect the Dog tick to pick up Biliary Fever infection in the larval stage and give it off in the nymphal, or pick it up in the nymphal and give it off in the adult, or pick it up in the adult stage and give it off in the larval stage, whereas it actually only picks up infection as an adult and the infection passes through the egg, larval and nymphal stages before being given off.

Battery Charging.

By MAJOR C. E. GOAD, M.C., Boring Superintendent.

This article is not a technical one, as such would be of little use to those for whom it is intended. It is merely written with the idea that some simple instruction for the care of batteries can be followed, and to prevent batteries being spoilt for want of a little care and attention.

Filling Caps are fitted on top of batteries; by removing these occasionally it can be observed if the battery plates are covered with fluid. At no time should the plates be left exposed. Shortage of fluid should be made up by the addition of distilled or clean rain water, which preferably had been collected in a non-metallic container. On no account should borehole, well or river water be used, as water from these sources contains mineral salts which are detrimental to batteries.

Caution.—Batteries should not be completely filled, the plates should only be a little more than covered.

When inspecting for topping up, the terminal points should receive attention, and these should be cleaned and covered with vaseline, which to some extent prevents corrosion. Filling plugs should be examined and vents opened, if blocked, to ensure that gas can escape.

Batteries should not be allowed to become entirely discharged, therefore some simple tests should be made, for which a hydrometer is necessary. The float will indicate a dead, half or fully charged battery.

In some cases it may be necessary to do the charging on a farm instead of having to send the battery in to a garage. This can be done satisfactorily, providing a generator and a little extra power, to the extent of about ½ h.p., is available. An old generator and cut-off from a car would be suitable. The generator should run at about 2,000 to 2,500 revs. per minute, at which speed the maximum output will be obtained. A flat or "Vee" endless belt can be used on a pulley of a suitable size, fitted to the generator, to give the correct speed. The generator should be mounted with some adjustment for tightening the belt, and should be absolutely rigid when bolted down.

The positive pole of the battery, as marked by the maker (usually a red or + sign), must be connected to the positive pole of the charging dynamo, and the negative pole of the battery to the negative pole of the dynamo.

A cut-out is essential as this controls the voltage; it closes the circuit to the battery when the generator produces a higher voltage than that required by the battery, and will disconnect the battery when the generator is not producing sufficient voltage, otherwise the battery will discharge itself into the generator. The rate of charging should be low, as by charging at a high rate the plates

are heated to such an extent that they are liable to buckle and lose their deposit of oxide, which would sink to the bottom of the cell, resulting in the battery not being able to hold the charge.

Do not overcharge, it is both wasteful of power and can do as much harm as charging at a high voltage.

Charging Rate.—First ascertain the capacity in actual ampere hours. The charging rate is obtained by dividing this figure by 10, e.g., a 60 ampere hour battery is charged at the rate of 6 amps.

Over-charging can be prevented if the time factor of charging is used in connection with a specific gravity test. For instance a 60 ampere hour battery is completely discharged; a charge at 6 amps should fill the battery in 10 hours, and an allowance should be made for waste and inefficiency. It is advisable, therefore, to allow, say, an extra 2 hours.

The hydrometer test should be carried out during the period of charging. Take a reading, say, after 6 hours, another at 9 hours, and thereafter each hour until the specific gravity remains constant. If no instrument is available a cell can be considered fully charged when it gases freely, almost like boiling water.

If a battery is to be out of use for a period of more than one month and charging cannot be carried out, the electrolyte should be emptied out into a clean glass or eathenware jar and stored. Rinse the cells with clean rain or distilled water, and refill the battery with a fresh lot of distilled water.

To bring the battery into use again empty out the water and fill with the original fluid, and then charge for a few hours.

If new batteries are received without any electrolyte, the electrolyte should be prepared as follows:

Only pure Brimstone sulphuric acid should be used. To mix the electrolyte the acid must be poured into water. This is accompanied by a considerable rise in temperature and the solution should be carefully stirred, preferably with a glass rod. **Water must on no account be poured into the strong acid,** as mixing this way may result in an explosion. The electrolyte should be allowed to cool before being poured into the cells. The correct density of the electrolyte is given with the maker's instructions on the hydrometer.

It will be found that a mixture of 5 parts pure acid to 21 parts of distilled water by volume gives the correct density for an uncharged battery.

When discharged the electrolyte will have a specific gravity of 1.17, and when fully charged 1.20 to 1.21.

House Lighting Batteries.—The plates are usually in glass cells. When fully charged the positive plates are rich dark brown in colour, and the negative plates a dull uniform lead grey colour.

Farming Calendar

LIVESTOCK.

NOVEMBER.

Cattle.—Normally rains should have fallen and the veld should be plentiful now. Beyond careful dipping, ranchers should not have much worry. If the season is bad, the poorer cattle should be drafted out and given a little hay, ensilage or maize daily.

In a normal year veld grazing should be plentiful in November, and the feeding of dairy stock is then very much simplified; veld grass in a green and succulent condition is practically all that is required for animals of less than average production. Heavy milking cows, however, on early pasture, require extra feed in the form of concentrates, while the latter should always be fed to dairy stock which are in poor condition at this time of the year. Young calves should not be turned out to graze with the herd, and in wet weather are best kept in a clean, dry, airy pen. Weaned stock, which have not hitherto had access to green pasture, should be gradually accustomed to the change in diet and may at first be turned out to graze for short periods. Young stock on pasture should also receive a small daily allowance of concentrates.

Sheep.—The rams should now be working well, only allow the rams with the ewes at night. During the day they should be kept at home and allowed with the ewes from 4 in the afternoon until 8 or 9 in the morning. Keep all sheep on the high dry lands. Where hookworm is present dose now.

DECEMBER.

Cattle.—Feeding should be continued on the same lines as in November Keep a close eye on any store bullocks that have been selected for fattening on grass.

Ranching cattle should not require any attention beyond dipping. Every effort should be made to have all the female stock in good condition for the breeding season.

During the months of December and January veld grazing is usually plentiful, and very little extra feed in the form of concentrates is required for dairy stock It should be borne in mind, however, that heavy milking cows are unable to satisfy their requirements for milk production from veld grazing alone, and should receive a daily allowance of grain; the latter should be fed at the rate of 2 lbs for every gallon of milk produced daily, i.e , a cow producing three gallons of milk should receive 6 to 7 lbs. of concentrates. An excellent mixture for this purpose is one consisting of four parts maize meal and one part ground-nut cake.

During wet weather, the provision of a clean dry shelter for calves is essential; the latter should not be crowded together in a small, damp, badly ventilated pen or muddy kraal. When treated in this manner, a calf is very liable to contract various ailments such as scour, etc. Scour is entirely preventable, and is usually caused by over-feeding, or feeding from dirty pails, feed boxes, etc. Calves which contract scour should be isolated, the milk ration reduced, and they should be dosed with a few tablespoonfuls of castor oil.

Sheep.—The rams should be taken out before Christmas and not run with the ewes throughout the year. Keep all sheep out of the vleis and dose regularly for wireworm and bankrot worms.

DAIRYING.

NOVEMBER.

Farmers supplying cream to the creamery should adjust the cream screw to the separator so that the latter will separate a cream testing 45 per cent. butter fat. Cream of this consistency will keep better than thinner cream. It should be borne in mind that it is practically impossible to

produce first-grade cream if the cattle are milked in a muddy kraal. In the absence of a cow shed, every endeavour should be made to erect a small milking shed in which four or five cows can be tied, milked and fed. A small shed of this kind is also essential to obtain clean milk for cheese-making. Milking in a muddy kraal invariably results in a gassy, bitter cheese being produced.

The shelves of the cheese room should be scrubbed with boiling water and soda, and for the last rinsing a weak solution of formalin may be used. This should prove effective in controlling cheese pests.

DECEMBER.

Under the weather conditions which now obtain, cream should be despatched to the creamery at least three times a week. It is of the greatest importance that cream should be cooled immediately after separation, and should be kept cool while on the farm and whilst in transit to the railway station or siding. While the cream is being cooled, it should be frequently stirred, using a stirrer with a plunger attachment. Warm, freshly separated cream should not be mixed with old cream which has already been cooled. Cool the fresh cream first and then mix thoroughly with the old cream. Gassiness is a common defect in the cream received at the creameries at this time of the year, and is caused by gas producing organism with which the milk and cream are contaminated These organisms abound in mud, manure, etc., and develop and multiply very rapidly at high temperatures. Any precautions therefore which may be taken to eliminate dirt, manure, etc , from the milk and to keep the cream cool will prevent the development of gassiness.

As the night temperatures are fairly high, cheese-makers should not attempt to use night's milk for cheese-making; morning's milk plus a starter will give the best results. Gouda cheese-making operations are not usually successful at this season of the year, owing to the poor quality of the milk and the prevalence of gassiness This type of cheese is best manufactured during March and subsequent months.

FORESTRY.

NOVEMBER.

The sowing of eucalypt seeds should be completed by the middle of this month If fresh seed of cedrella toona is available, sowing should be made. Keep the seed beds moist and free from weeds. The tap roots of early seedlings may be cut back in order to form hardy, stocky plants most suited for planting. Continue with pricking out if transplants are to be used Prepare all land to be planted by cross-ploughing and harrowing. A well prepared soil is a good fertiliser, it assists establishment and reduces failures. Fires are still a menace, and all fireguards should be kept in order.

DECEMBER

Final preparation for planting should be made, including harrowing or pitting. Early plantings may be carried out if the season is a good one Planting should be carried out on dull, rainy days, or failing such day, late in the afternoon. Great care should be exercised in planting out to avoid bending the tap root, and to set the trees in the ground at the same level as they were in the seed bed or tray. Late sowings of cedrella toona may be made.

CROPS.

NOVEMBER.

Have you a reserve of seed maize for replanting? Take note when the first rains fall, and see what leaks there are, if any, in the farm buildings. Do not neglect to effect such repairs as are necessary. Early in the month see that the planters are in perfect order, and that they drop the different seeds to be planted evenly and at the right distance Try them out on the farm road. Hasten the work of getting the lands for early sown crops into as good a condition for seeding as possible, so that the first and most favourable opportunity for planting may be seized. The young plants make more rapid growth in a good seed bed. Utilise exceptionally early rains for this purpose rather than for planting. The holes for check row planting

of maize can continue to be prepared until sufficient rain has fallen to allow of planting. Velvet beans and dolichos beans for seed or hay may be planted dry if the land is in good order. With favourable weather, planting of maize, velvet and dolichos beans will commence about the middle of the month, and will continue as the condition of the land and the rainfall permit. Main crop potatoes should be planted from now on to January. Dhal may be planted for seed or green manuring—if for seed, a frost free situation is necessary. Kaffir corn for seed may be planted this month. Green-manure crops requiring a long growing season should be planted. Destroy, by feeding or burning, early planted trap crop of maize or volunteer plants which have become infested with stalk-borer. Plant the first of two traps for wtichweed before the rains. It can be sown on a stubble and covered by disc-harrow.

If weeds are beginning to show, keep the harrows going in front of the planters. If weeds are too advanced to be killed by drag harrows and too numerous to be dealt with by hand labour, use the disc-harrow or lightly re-plough the land. If the tilth is good, do not be afraid to harrow the young maize. This will save much labour later on by destroying the weeds while they are small

Check-row your maize to reduce hand labour on witchweed control, or plant at 6 feet by 9 inches and use a spring-tooth cultivator

DECEMBER.

Keep the cultivators going, both on planted and unplanted lands, whenever weather conditions are favourable. Destroy the weeds while young and before they obtain a firm root-hold Turn your compost heaps after top 6 inches is wetted; and on a wet day.

Continue planting maize, beans and ground nuts as early as possible this month, followed by sunflowers, Sudan grass, manna, pumpkins and cattle melons. Linseed, cowpeas, teff grass, Kherson and S.E.S., oats. Sunnhemp should be planted after the other crops are in Ensilage crops may be sown at the end of the month. When harrowing young maize this work should be done in the heat of the day when the young plants are flacid and not easily broken. On lands not yet planted the crop of weeds should be kept down by disc-harrowing. It is a good plan to harrow or disc harrow immediately before the planter, or alternatively to follow the planter with a light harrow. Treat seed oats and sorghums for smut before sowing. Earth up early planted potatoes. Keep a look out for the stalk-borer, and top or otherwise treat affected plants. New lands and old pastures may be broken, as circumstances permit, during December, January and early February, and again ploughed from May to July. If they carry a heavy crop of grass it should be burnt to enable good, clean ploughing to be done and to kill witchweed seed. Sweet potato slips should be planted early in this month. Every farmer should have in a few acres of this valuable crop.

Rhodesian Milk Records.

SEMI-OFFICIAL. COMPLETED LACTATIONS.

Name of Cow.	Breed.	Age	Milk in lbs	B Fat in lbs.	Average % B. Fat.	No. of Days.	Name and Address of Owner.
Febbie	L R Shorthorn	Mature	4699 50	216 07	4.60	242	G R. Morris, Box 1040, Salisbury.
No. 23	L.R Shorthorn	Mature	5374 50	211.22	3 93	284	
Joseph	L R Shorthorn	Mature	4840 00	215 13	4 44	243	
No 22	L.R Shorthorn	Mature	4788 00	226 53	4 73	300	
Antionette	L.R Shorthorn	Mature	5554 00	240 99	4 34	300	
No. 121	G. Friesland	Mature	4755 20	203 01	4 27	279	H A. Day, Box 1153, Salisbury.
No. 107 . , ...	G Friesland	Mature	7711.40	283 52	3 68	280	
A. 40	G Friesland	Mature	6846 10	207 78	3.04	287	
No 125 . ..	G Friesland	Mature	6227 30	238 82	3 83	300	
No 112	G Friesland	3 years	5696 80	217 97	3 83	300	
A. 91	G. Friesland	Mature	6900 20	207 98	3.01	298	
Erica	G Friesland	Mature	7736 50	296 08	3 82	300	V. A Lawrence. Knockmaroon, Norton
Buttercup ...	G. Friesland	Mature	6541 50	257 99	3 94	288	
Cataquara . ..	G Friesland	Mature	6968 70	257 65	3 70	300	Mrs. M Huxham, Spitzkop, Mazoe.
No. 25	G Friesland	Mature	7002 30	220 93	3 16	300	Sir G Huggins, The Craig, Enterprise
No. 45	G Friesland	4 years	7628 00	252 93	3 32	300	Messrs Mazoe Citrus Estate, Mazoe.
No. 46	G. Friesland	4 years	5897 50	218 40	3 72	300	
Trixie	G Friesland	Mature	10046 10	345 84	3 44	300	W. Sole, Bauhinia, Glendale
Hilary	G Friesland	4 years	7912 10	257 28	3.25	300	
Katie	G Friesland	3 years	6899 30	212 43	3 09	300	
Delia	G Friesland	3 years	6452 20	219 66	3 40	300	
Meg	P B Ayrshire	Mature	6511 50	274 33	4 21	277	D J Huddy, Box 899, Salisbury.
Ndegi	G Friesland	Mature	5370 00	203 70	3 47	250	
Plum-Duff ..	G Friesland	Mature	7552 00	249 51	3 30	300	
Blossom	G Friesland	Mature	7155 30	233 25	3 26	254	
Mayo . . .	G Friesland	Mature	7231 50	244 81	3 39	300	F Neill, Box 455, Salisbury
Black and White	G Friesland	Mature	7042 00	236 63	3 36	273	
Kanyemba	G Hereford	Mature	4853 50	220 00	4 53	232	
Nightingale	G Ayrshire	4 years	5430 50	224 11	4 13	300	E L. Morant, Box 741, Salisbury.
Susan .	G Friesland	Mature	4838 00	228 37	4 72	275	
Gilston Marina .	G. Red Poll	4 years	4958 99	207 19	4 18	300	G N. Fleming, Box 688, Salisbury
Jim .	G Friesland	4 years	5277 70	201 21	3 82	268	S Moore. Box 999, Salisbury.
Ben . .	G Friesland	Mature	4409 70	201 85	4 58	249	
Hurali .	G Friesland	Mature	6992 20	287 95	4 05	270	
Bicycle . .	G Friesland	Mature	4645 80	216 13	4 70	258	
Tivoli . .	G Friesland	Mature	4993 90	201 75	4 04	262	
Black .	G Friesland	2 years	5565 60	269 94	4 76	300	
Jess I . .	G. Hereford	Mature	5311 80	235 26	4 43	264	
Freckles	G Hereford	Mature	5945 20	287 69	4 84	300	
Moffat ..	G Red Poll	Mature	5094 30	212 55	4 17	300	J G Thurlow, Atherstone, Bindura
Bindura	G Friesland	Mature	6060 90	243 97	3 96	300	
Nyama	G Friesland	4 years	6654 50	259 39	3 90	300	
England	G Friesland	4 years	5796 30	244 39	4 05	273	
Ann	G Friesland	2 years	6101 30	229 58	3 76	300	J A. Baxter, Box 1368, Salisbury.
Russia ..	G Friesland	4 years	6258 30	226 47	3 62	300	
Blossom .	G Friesland	Mature	11758 30	439 27	3 73	300	
Leslie	G Friesland	Mature	6588 70	259 67	3 94	300	
Lomans	G Friesland	Mature	10913 10	357 57	3 28	300	W F H Scutt, Maple Leaf, Norton
Darwin	G Friesland	Mature	5597 30	256 53	4 58	300	

In the semi-official milk records published in the July/August issue of the R.A J. Mr. Campbell's Red Poll cow Pinkie was credited with producing 143.91 lbs. butter fat in 300 days. This figure should have read 343 91 lbs butter fat. This Red Poll cow has eclipsed any other milk and butter fat records for this breed in Mashonaland.

Southern Rhodesia Veterinary Report.

JULY, 1942.

Diseases.—Anthrax was diagnosed on farm Doornboom, Gwanda district.

Tuberculin Test.—Two bulls and forty-six cows and heifers were tested on importation. There were no re-actors.

Mallein Test.—Eight horses were tested on importation with negative results.

IMPORTATIONS.

Union of South Africa.—Bulls, 2; cows, heifers and calves, 81; horses, 12; sheep, 997.

Bechuanaland Protectorate.—Slaughter cattle, 203; sheep and goats, 432.

EXPORTATIONS.

Union of South Africa.—Horses, 3.

Northern Rhodesia.—Bulls, 21; sheep, 196.

Portuguese East Africa.—Slaughter cattle, 120; sheep and goats, 87.

EXPORTATIONS—MISCELLANEOUS.

In Cold Storage.

United Kingdom.—Beef quarters, 766; mutton carcases, 329; pork carcases, 93; tongues, 1,579 lbs.; livers, 1,514 lbs.; hearts, 1,522 lbs.; sausages, 12,170 lbs.; beef casings, 3,400 lbs.

Northern Rhodesia.—Beef carcases, 587; mutton carcases, 165; pork carcases, 25; veal carcases, 5; offal, 14,845 lbs.

Belgian Congo.—Beef carcases, 396; mutton carcases, 83; veal carcases, 9; offal, 2,647 lbs.

Meat Products from Liebigs (Rhodesia), Ltd. Factory, West Nicholson.

Union of South Africa.—Meat extract, 9,396 lbs.; assorted sausages, 14,400 lbs.

B. A. MYHILL,
Chief Veterinary Surgeon.

AUGUST, 1942.

Diseases.—Anthrax was diagnosed on farm Umunwe, Insiza district.

Tuberculin Test.—Five bulls and 90 cows and heifers were tested on importation with negative results.

Mallein Test.—Nil.

IMPORTATIONS.

Union of South Africa.—Bulls, 6; cows, 66; sheep, 709.

Bechuanaland Protectorate.—Slaughter cattle, 155; sheep and goats, 390.

EXPORTATIONS.

Union of South Africa.—Horses, 1.

Belgian Congo.—Horses 11.

Portuguese East Africa.—Slaughter cattle, 141; sheep, 45.

EXPORTATIONS MISCELLANEOUS.

In Cold Storage.

United Kingdom—Beef quarters, 90; livers, 6,061 lbs; sausages, 12,923 lbs

Northern Rhodesia Beef carcases, 479, mutton carcases, 186; pork carcases, 19; veal carcase, 1; offal, 13,978 lbs

Belgian Congo.—Beef carcases, 383; mutton carcases, 136; pork carcases, 17; veal carcases, 22; offal, 2,755 lbs.

Meat Products from Liebigs (Rhodesia) Ltd. Factory, West Nicholson.

Union of South Africa.—Meat extract, 28,026 lbs.

Northern Rhodesia.—Corned beef, 256,500 lbs.; assorted rolls, 5,808 lbs.

B. A. Myhill,
Chief Veterinary Surgeon.

SEPTEMBER, 1942.

Diseases.—Nothing to report.

Tuberculin Test.—Eleven bulls and 87 cows and heifers were tested on importation. One cow reacted to the test and was destroyed.

Mallein Test. Ten horses and 20 donkeys were tested with negative results

IMPORTATIONS.

Union of South Africa.—Bulls, 15; cows and heifers, 89; sheep, 863.

Bechuanaland Protectorate.—Slaughter cattle, 12; sheep and goats, 273; horses 7.

EXPORTATIONS.

Northern Rhodesia.—Bull, 1; cows and heifers, 6, horses, 3; sheep, 95.

Portuguese East Africa—Slaughter cattle, 150; sheep, 42.

EXPORTATIONS—MISCELLANEOUS.

In Cold Storage.

United Kingdom.—Beef quarters, 349; pork carcases, 353; tongues, 10,218 lbs.; livers, 20,840 lbs.; hearts. 2,320 lbs.; tails, 4,892 lbs.; sausages, 13,369 lbs.

Northern Rhodesia. Beef carcases, 680: mutton carcases, 280; pork carcases, 16; veal carcases, 9; offal, 14,839 lbs.

Belgian Congo.—Beef carcases, 706; mutton carcases, 107; veal carcases, 49; offal, 2,554 lbs.

Meat Products from Liebigs (Rhodesia) Ltd. Factory, West Nicholson.

Union of South Africa.—Assorted rolls, 3,000 lbs.; meat extract, 12,060 lbs.

B. A. MYHILL,
Chief Veterinary Surgeon.